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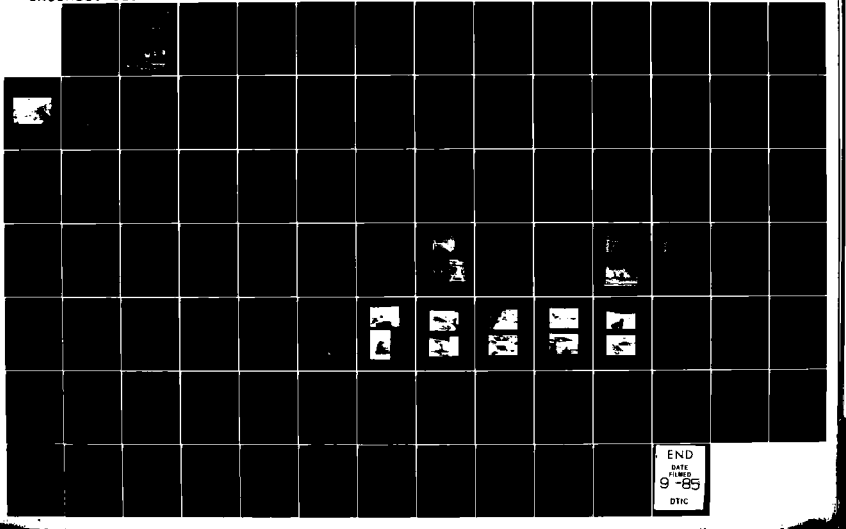

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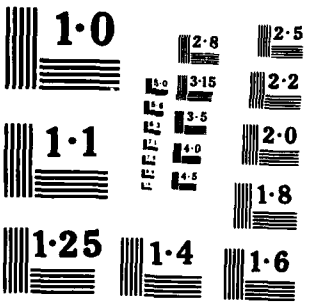
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BLACKSTONE RIVER BASIN
NORTH SMITHFIELD, RHODE ISLAND

FORESTDALE POND DAM
RI 02504

PHASE 1 INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JUNE 1980

UNCLASSIFIED

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Blackstone River Basin
North Smithfield, Rhode Island
Branch River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam has an overall length of 108.5 ft. and is 19.5 ft.high. The dam is judged to be in poor condition with several deficiencies that require attention. The dam is small in size with a significant hazard potential. There are various remedial measures which must be undertaken by the owner.

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FORESTDALE POND DAM

R.I. 02504

BLACKSTONE RIVER BASIN

NORTH SMITHFIELD, RHODE ISLAND

PHASE 1 INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

Identification No:	R.I. 02504
Name of Dam:	Forestdale Pond Dam
Town:	North Smithfield
County and State:	Providence County Rhode Island
Stream:	Branch River
Date of Inspection:	6 November 1979

Brief Assessment

The dam at Forestdale Pond is 19.5 feet high and has an overall length of 108.5 feet of which 92 feet is unobstructed overflow spillway. The dam is founded on ledge and built of stone masonry with hammer dressed beds and joints, laid in continuous courses and cemented. The spillway extends across the entire length of the dam but is divided into four sections by 3 walkway pier structures. The dam is slightly arched with the arch facing upstream. The spillway has provision for installations of flashboards. The outlet works for the dam is located at the left abutment, adjacent to the mill structure, and is 4 feet H by 4.5 feet W draw-off gate. Additionally, the adjacent mill complex has a provision for generating power within the complex. Water was withdrawn from the upstream pool through 2-10 feet H by 7.5 feet W intake gates which feed 2 - type "Z" - 200 horsepower vertical wheel turbines. Discharges through the turbines re-enter the river just downstream from the dam.

The assessment of the dam is based on the visual inspections and review of limited existing data only, since engineering, operational and maintenance records have not been maintained. The dam is judged to be in POOR condition with several deficiencies that require attention. These detrimental features include: an inoperable draw-off gate, extensive leakage through the headrace and turbine tunnels around the dam, seepage at the right abutment and an inadequate spillway capacity to pass the routed test flood outflow.

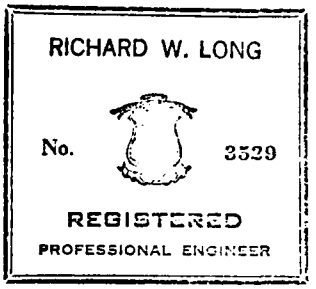
The dam is classified as SMALL but a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The selected test flood inflow for this dam is equal to one-half the Probable Maximum Flood (PMF) or 17,500 CFS and the routed test flood outflow is equal to approximately 17,400 cfs and would overtop the dam by 6.6 feet. The maximum spillway discharge of 5,000 cfs represents 28.7 percent of the total test flood outflow.

It is recommended that the Owner engage the services of a qualified registered engineer to accomplish the following: investigate and recommend solutions to the leakage of flows around the dam through the partially destroyed powerhouse; analyze the hydrology and hydraulics of the dam to develop alternative corrective solutions to improve the discharge capacity and reduce the overtopping potential; investigate the seepage at the right abutment of the dam; develop an inspection and maintenance program, and establish an "emergency action plan."

Additional recommendations and remedial measures are detailed in Section 7 and should be implemented by the Owner within one year after receipt of this Phase I Inspection Report.

CE Maguire, Inc.

By: Richard W. Long
Richard W. Long, P.E.
Vice President



This Phase I Inspection Report on Forestdale Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and are hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or to property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonable possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

TABLE OF CONTENTS

APPENDICES

3. The inoperable draw-off gate eliminates any means for regulating the pool for maintenance or repair.

4. Gates leading to the old turbine installations could also be in poor condition and could fail releasing water around the dam and through the powerhouse structure.

5. Walkway support piers will act as debris catchers and could conceivably result in increased loads on the dam and clogging of the spillway.

c. Appurtenant Structures

The old powerhouse for the mill along the left abutment is collapsing and in very poor condition. Water under pressure was observed coming up through the floor in the lower exposed room in the downstream side of the powerhouse. The floor of this room is below the reservoir level. The water in this room was then exiting through a hole in the riverside brick masonry wall of the powerhouse (Photo C-6). Water was also observed flowing through the joints at numerous locations in the stone masonry wall just downstream of the powerhouse chimney and also through the joints in the stone masonry wall between the dam and the upstream side of the concrete wall for the powerhouse (Photo C-4).

The stone masonry retaining wall upstream of the dam along the intake structure and intake forebay are in fair to poor condition with trees and saplings growing from between the joints in the wall. The trash rack in the intake was blocked with debris (Photo C-5).

d. Reservoir Area. The shoreline perimeter of Forestdale Pond is moderate to steep sided with vegetation and trees covering the banks. Floating debris can easily snag the pier supports of the dam and obstruct the flow and therefore should be monitored (Photo C-9).

e. Downstream Channel

The downstream channel is the natural channel. No obstructions to flow were observed in the vicinity of the dam. Below the dam, approximately 600 feet, is the main sub-aqueous sanitary sewer crossing for the North Smithfield sewer system (Photos C-7 & C-8).

3.2 Evaluation

Based on visual observations, the dam appears to be in poor condition and the remnants of the old powerhouse are also in poor condition. Due to the water flowing over the spillway, the conditions of the downstream face and the toe of the dam could not be assessed. The following features could adversely affect the future performance of the dam:

1. Continued deterioration of the remnant powerhouse could lead to further structural failure of the building with the effect of releasing water around the left abutment of the dam.

2. Trees growing from the upstream stone masonry retaining wall and from beneath the rightmost pier on the dam crest will result in further deterioration of the dam.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The Phase I Inspection of the dam at Forestdale Pond was performed on 6 November, 1979, by representatives of CE Maguire, Inc., and Geotechnical Engineers, Inc.

Based on the visual inspection, history, and general appearance, the dam is judged to be in POOR condition.

b. Dam. The dam is a run-of-the-river dam with a vertical downstream stone masonry wall. The remnants of a mill powerhouse remain at the left abutment. Between the powerhouse and the right abutment, the dam is a spillway section with the exception of a short length at the right abutment (Photos C-2 & C-3).

Since there was water flowing over the spillway at the time of the inspection, the condition of the crest and upstream face could not be observed. There are four concrete piers located along the crest which apparently once supported a walkway which spanned the crest (Photo C-1). The concrete on the upstream side of the piers above the pool level was badly spalled. A crack and gap was noted on the downstream side of the third concrete pier from the right abutment near the top of the stone masonry downstream face. A 6-inch-diameter tree was growing from beneath the first pier near the right abutment (Overview Photo).

Wooden flashboards were observed between the concrete piers.

The downstream face of the dam is a vertical stone masonry wall and appeared to be in generally good condition (Photo C-4), even though a detailed inspection was not possible because of the water flowing over the spillway.

Water was observed flowing from an opening in the downstream face near the right abutment (Photo C-3). It was not apparent if this opening was a design outlet or whether it was actually the result of the removal of a granite block from the wall.

The right abutment consists of a schist bedrock. Water flow at the contact of the stone masonry wall of the dam and the bedrock abutment was observed (Photos C-3 & C-10). There is some erosion at the abutment above the elevation of the crest of the dam, which indicates that overtopping may have occurred in the past (Photo C-10).

SECTION 2

ENGINEERING DATA

2.1 Design Data

The following documents which contain the principal information regarding this dam were reviewed in the preparation of this report.

1. Plan of Forestdale Dam #48 - Rhode Island Department of Public Works, Division of Harbors and Rivers by the Works Projects Administrated March 4, 1941.

2.2 Construction Data

No record of construction or repairs exists to supplement the above information.

2.3 Operation Data

The reservoir is presently used for recreation and is not regulated. No operating records have been maintained for this facility.

2.4 Evaluation of Data

a. Availability. The information noted above for this facility is available in the files of the Dam Section, Land Resources Department of Environmental Management - State of Rhode Island.

b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assured from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance and sound engineering judgement.

c. Validity. The validity of the limited data must be verified.

3.	Description	Rectangular stone masonry
4.	Control Mechanism	Manually operated sluice gate
5.	Other	-----

6.	Zoning	Stone Masonry Construct.
7.	Impervious core	Stone Masonry Construct.
8.	Cutoff	Stone Masonry Construct.
9.	Grout curtain	Stone Masonry Construct.
10.	Other	Entire length of dam is spillway

h. Diversion and Regulating Tunnels — Two large gates (each 10' x 7.5') were used to supply flowage to the turbines installed in the mill. These gates could be rehabilitated to divert flow around the dam.

i. Spillway

1.	Type	Free overflow broad crested stone masonry, curved with provision for flashboards.
2.	Length of weir	92.0 ft. = Entire length of dam.
3.	Crest elevation	199.0
4.	Gates	None
5.	U/S Channel	Natural bed of Forestdale Pond
6.	D/S Channel	Natural bed of Branch River
7.	General	-----

j. Regulating Outlets

Refer to Paragraph 1.2b "Description of Dam and Appurtenances" Page 1-2 for description of outlet works.

1.	Downstream invert	-----
2.	Size	4'H x 3'W

5.	Test Flood pool	2,700

e. Storage (Acre-Feet)

1.	Normal pool	160
2.	Flood control pool	N/A
3.	Spillway crest	160
4.	Top of dam	280
5.	Test flood pool	411

6. Net storage between the top of the dam (Elevation 204.0) and the spillway crest (Elevation 199.0) is 100 Ac-Ft and represents 0.020 inches of runoff from the drainage area of 91.2 square miles.

7. Each foot of surcharge storage from spillway crest to top of the dam equals 0.004 inches of runoff.

f. Reservoir Surface Area (Acres)

1.	Normal pool	20
2.	Flood Control pool	N/A
3.	Spillway crest	20
4.	Test flood	20
5.	Top of Dam	20

g. Dam

1.	Type (based on visual inspection)	Granite stone laid in continuing courses and cemented
2.	Length	Gross Length = 108.5 Effect. Length = 92.0 ft.
3.	Height	19.5 ft.
4.	Top width	3.0 ft.± (estimated)
5.	Side slopes	
	i) Upstream	Unknown
	ii) Downstream	Vertical

Note: Test flood elevation 210.6 feet is higher than top of dam elevation 204.0

5.	Gated spillway capacity at normal pool elevation	N/A
6.	Gated spillway capacity at test flood elevation	N/A
7.	Total spillway capacity at test flood elevation	N/A
8.	Total project discharge at top of dam	5,228 CFS Elevation 204.0 feet
9.	Total project discharge at test flood elevation (includes outlet works)	17,728 CFS Elevation 210.6 feet

c. Elevations (Feet above NGVD)

1.	Streambed at toe of dam	184.50
2.	Bottom of cutoff	Unknown
3.	Maximum tailwater	Unknown
4.	Recreation pool	199.0
5.	Full flood control pool	N/A
6.	Spillway crest (ungated)	199.0
7.	Design discharge (original design)	Unknown
8.	Top of dam	204.0
9.	Test Flood level	210.6

d. Reservoir Lengths (in feet)

1.	Normal pool	2,700
2.	Flood control pool	N/A
3.	Spillway crest pool	2,700
4.	Top of dam pool	2,700

of 804 MSL at Durfee Hill in northwestern Rhode Island to a low elevation of 199 MSL at the Forestdale Dam. The main stream slope averages 16.0 feet/mile. Scattered throughout the hilly terrain of the basin are many lakes, ponds and artificial reservoirs which were originally developed for processing of industrial goods in connection with textile manufacturing and finishing. The time of concentration for the entire basin is estimated to be greater than 20 hours which is relatively large. Peak flows should be attentuated by the numerous natural and manmade storages and runoff should not peak simultaneously at the damsite.

b. Discharge at Damsite. Records published by the U.S. Geological Survey for the Branch River Gaging Station #01111500, located 400 feet below the dam, for the period January, 1940 to the present, list the following extremes:

Maximum Discharge - 4980 CFS - March 18, 1968
Maximum Discharge since 1886 - 5800 CFS - March 19, 1936
Maximum Discharge for Year 1978 - 880 CFS

Listed below are discharge data and other pertinent data:

1. Outlet Works:

Conduit size	4'H x 3'W Invert Elevation = 185.74 feet
i) Discharge capacity	246 CFS at Spillway crest Elevation = 199.0 feet
ii) Discharge capacity	288 CFS at top of dam Elevation = 204.0 feet
iii) Discharge capacity	328 CFS at test flood Elevation = 210.6 feet

2. Maximum known flood at damsite:

i) March, 1936	5,800 CFS
ii) August 21, 1955	4,220 CFS
iii) March 20, 1968	4,980 CFS

3. Ungated spillway capacity at top of dam	5,000 CFS Elevation 204.0
4. Ungated spillway capacity at test flood elevation	N/A

mill complex. The mill has recently been destroyed and razed and the dam is no longer used.

h. Design and Construction History. Annual reports of the Commissioners of Dam and Reservoirs for the State of Rhode Island indicate that this dam was constructed about 1883. In 1928 new concrete gates were installed to regulate water flow to the turbines. A 1946 inspections report by the State of Rhode Island reports that power was generated at this facility for 9 months of each year. Some repair work was proposed for 1947 that included concrete facing of the walkway support piers that cross the dam. It is unknown if this work was accomplished. In 1978 the entire mill complex was destroyed by fire and the buildings demolished in early 1979. (See overview photo). The dam now provides only an upstream recreation pool and is abandoned.

i. Normal Operational Procedure. The dam is not operated.

1.3 Pertinent Data.

a. Drainage Area. The Forestdale Pond Dam drainage basin encompasses the entire Branch River Basin, the largest tributary to the Blackstone River. The basin at the dam is equal to 91.2 square miles of which 12.6 square miles are in Massachusetts. The basin is shaped much like an equalateral triangle, with each side approximately 15 miles long.

The main stream of the Branch River is formed by the confluence of the Chepachet and Pascoag - Clear Rivers near the village of Oakland in the Town of Burriville, Rhode Island, and terminates at the Blackstone River in North Smithfield, Rhode Island near the Massachusetts - Rhode Island State boundary. The northern fork of the Branch River (drainage area 44.7 square miles) originates on the Clear River at Wallum Lake in the extreme northwestern corner of Rhode Island and flows in a southeasterly direction through the Wilson Reservoir to join with the Pascoag River just north of the village of Pascoag, Rhode Island. The Clear-Pascoag River is joined by the Nipmuc River just north of the village of Harrisville, Rhode Island, thence continues flowing generally southeasterly to Oakland to form Branch River. The southern fork (drainage area 21.2 square mile) originates in the swamps upstream of the Smith and Sayles Reservoir in Glocester, Rhode Island and flows in a northeasterly direction through the village of Chepachet to Oakland, Rhode Island. Another southern tributary, Tarklin Brook, joins the Branch River at the southwestern extremity of the Slatersville Reservoir near the village at Nasonville, Rhode Island.

The Branch River and its tributaries drain a watershed with a mean elevation of 475 MSL; which extends from a high elevation

b. Description of Dam and Appurtenances. The Forestdale Pond Dam has an overall length of 108.5 feet of which 92 feet is unobstructed overflow spillway. The dam is founded on ledge and built on stone masonry with hammer dressed beds and joints, laid in continuous courses and cemented. The rollway (spillway) extends across the entire length of the dam but is divided into four sections by three walkway pier structures. The dam is slightly arched with the arch facing upstream. The spillway has provision for installations of flashboards. The outlet works for the dam is located at the left abutment, adjacent to the mill structure, and is 4 feet H by 4.5 feet W draw-off gate. Additionally, the adjacent mill complex has a provision for generating power within the complex. Water was withdrawn from the upstream pool through 2-10 feet H by 7.7 feet W intake gates which feed 2 - type "Z" - 200 horsepower vertical wheel turbines. Discharges through the turbines re-enter the river just downstream from the dam.

c. Size Classification. Forestdale Pond Dam has an impoundment capacity at the top of the dam (Elev. 199.0) equal to 280 Ac-Ft. and a maximum height of 19.5 feet. In accordance with the criteria established by the Corps of Engineers, this dam is classified as a SMALL structure based upon both height and impoundment criteria.

d. Hazard Classification. The dam is classified as having a SIGNIFICANT hazard potential because its failure may result in loss of a few lives, damage to the Branch River gaging station, the North Smithfield trunk sanitary sewer main, Forestdale Bridge #445 (Route 146), Branch River Bridge #108 (Route 146-A) and a utility crossing and mill building adjacent to the roadway. Water depths, due to the failure discharge of 9,500 CFS for the dam, may range from 15 feet immediately downstream of the dam to 12.0 feet at the confluence of the Branch and Blackstone Rivers. At the time of the failure of the dam, high wave velocity will cause scouring of channel bed and banks; may undermine the foundations of 1-3 structures (bridges and buildings) increasing the potential for damage.

e. Ownership. Forestdale Pond dam is owned by:

Mr. Robert N. Meunier
P.O. Box 451
Lake Road
Newport, Vermont

f. Operator. The Owner has no agent present to operate the facility.

g. Purpose of Dam. The dam was originally constructed to provide an upstream pool for the generator of power for an adjacent

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

FORESTDALE POND DAM

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. CE Maguire, Inc., has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed was issued to CE Maguire, Inc., under a letter from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-80-C-0013 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection.

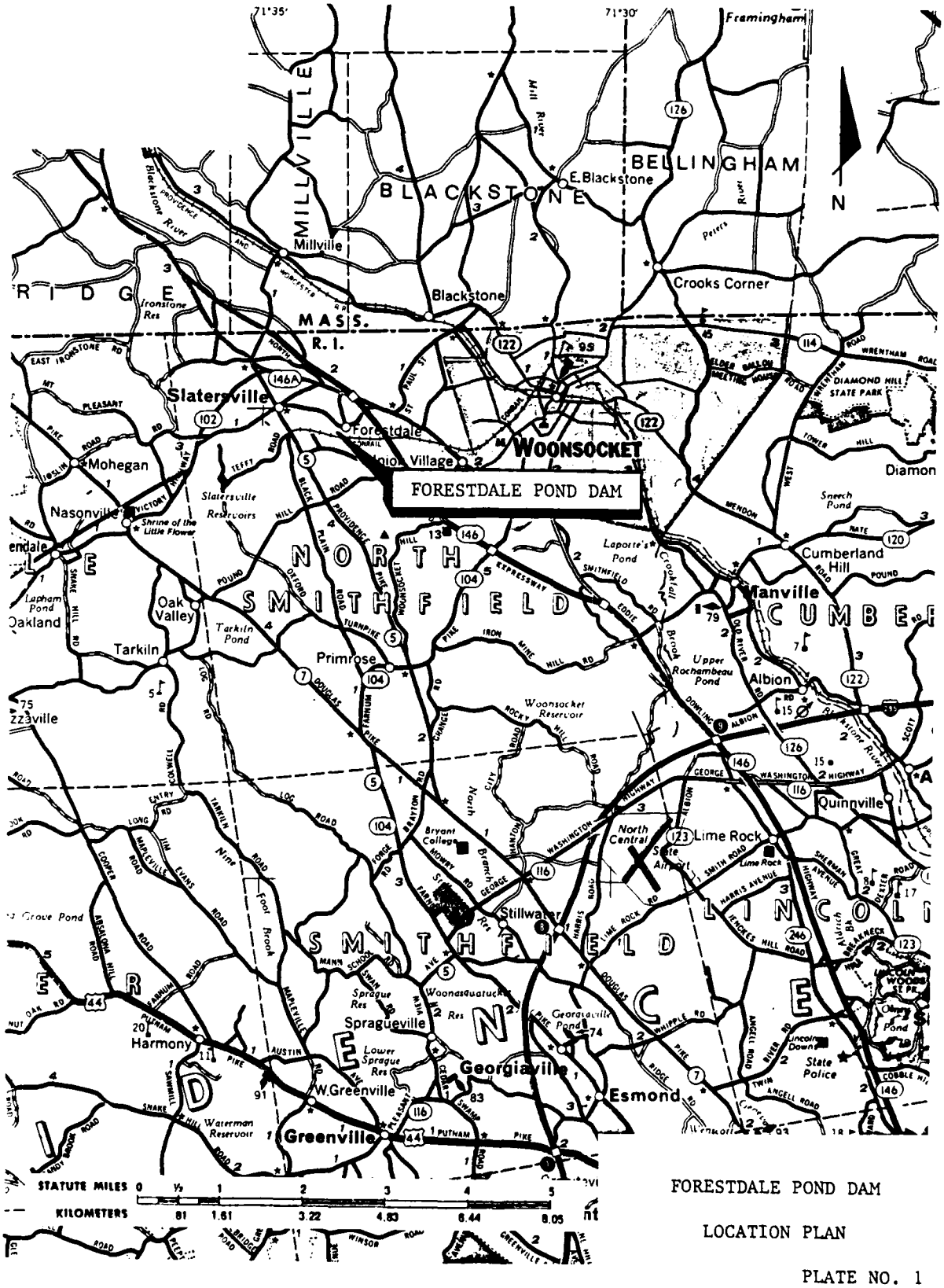
1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and assist the State to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify, and complete the National Inventory of Dams.

1.2 Description of Project

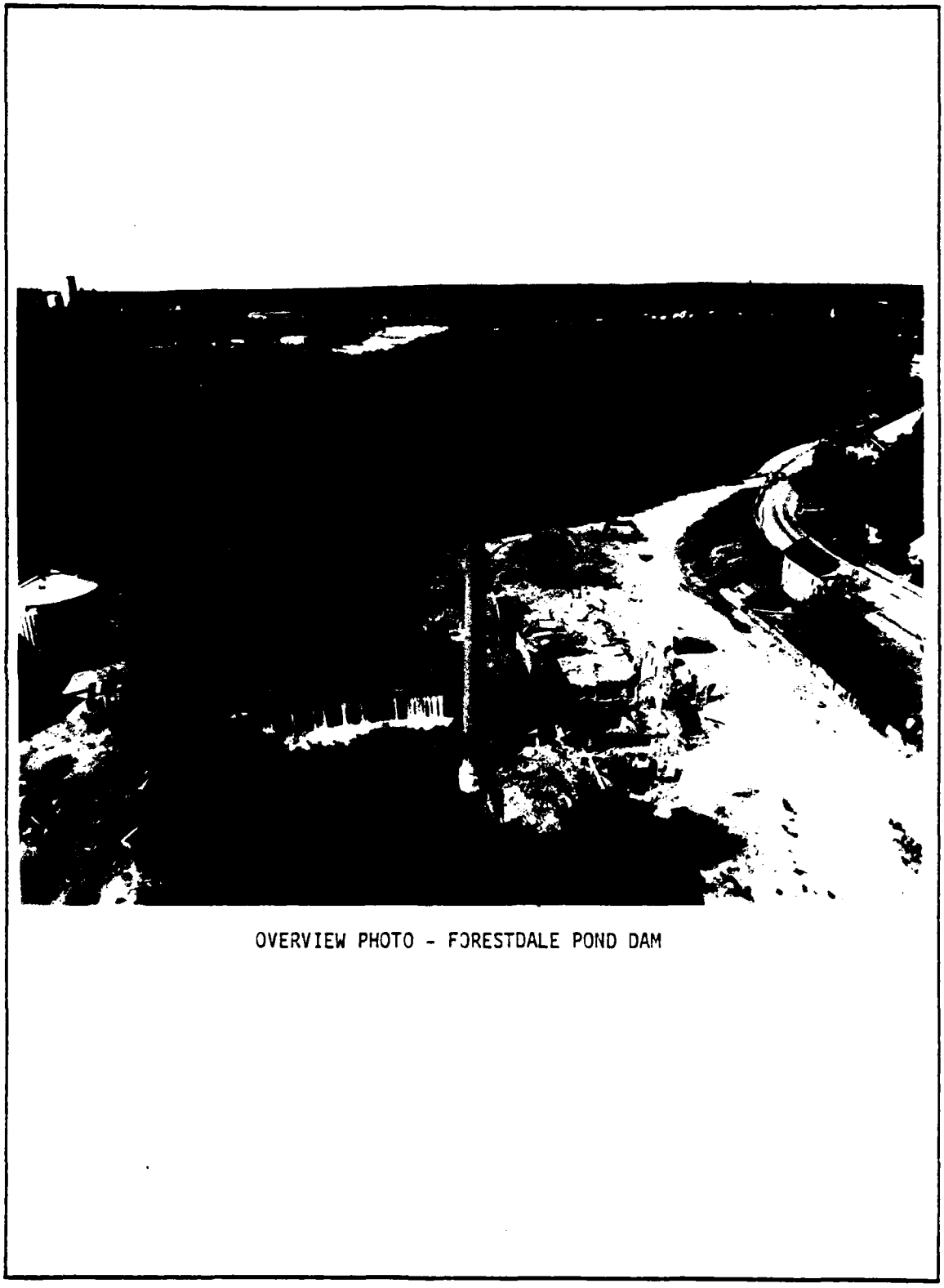
a. Location. Forestdale Pond Dam is located on the Branch River in the Town of North Smithfield, Providence County, Rhode Island, approximately 1.5 miles upstream from the confluence of the Branch River and the Blackstone River. Coordinates of the dam are approximately 41° 59.8' N Latitude and 71° 33.8 W Longitude. The dam impounds water from the Branch River which drains a 91.2 square mile drainage basin of hilly terrain that covers most of the northern Rhode Island and portions of Douglas, Massachusetts.



FORESTDALE POND DAM

LOCATION PLAN

PLATE NO. 1



OVERVIEW PHOTO - FORESTDALE POND DAM

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. The storage at Forestdale Pond Dam is used for recreation only and at present is not maintained. The impoundment is not regulated, and all downstream discharges are the result of spillway overflows and leakage through the gates of the demolished powerhouse, adjacent to the dam.

b. Description of Any Warning System in Effect. There is no warning system in effect for this dam.

4.2 Maintenance Procedures.

a. General. There is no program of maintenance for this dam, at present. The facility appears to be abandoned.

b. Operating Facilities. Operating facilites have not been maintained. The present draw-off gate is inoperable and the condition of the control gates leading to the former turbine installation is indeterminate.

4.3 Evaluation. There is no regularly scheduled maintenance for this dam. The adjacent mill complex has been destroyed by fire and subsequently razed. The former powerhouse structure adjacent to the dam is in poor condition with flow through the leaking headrace gates and turbine tunnels unchecked. The outlet works gate at the dam is inoperable. A systematic inspection and rehabilitation program should be developed and implemented. Once the operating equipment has been restored to service the gates should be periodically exercised and tested to insure proper performance. The condition of the spillway should be determined based on an inspection during a no-flow condition.

An emergency action plan should be developed and implemented that will provide for inspection and monitoring of the facility by a representative of the Owner and a course of action to be followed during critical situations. The plan should include as a minimum: the authorities to be contacted; the locations of emergency materials, equipment or manpower to prevent or minimize failure and dewatering procedures to be followed.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General. The dam at Forestdale Pond is located on the Branch River, in northern Rhode Island, approximately 1.5 miles upstream from the confluence of the Branch and Blackstone Rivers. The dam was constructed about 1883 to provide process water and power generation capacity for the adjacent mill complex. The drainage basin is equal to 91.2 square miles and contains numerous dams and natural storage areas.

The dam is a cut stone masonry overflow structure 108.5 feet in total length. The clear unobstructed spillway length is equal to 92 feet. The storage pond created by the dam has a capacity of 160 Ac-Ft at the spillway crest level and can accommodate 0.032 inches of runoff from the catchment area. Each foot of depth in the reservoir above the spillway can store 20 Ac-Ft or 0.004 inches of effective rainfall.

5.2 Design Data. Limited design data is available for this watershed and dam. To supplement the existing design information U.S.G.S. Topographic Maps (scale 1" = 2,000 ft.) were utilized to develop hydrologic parameters such as drainage area, reservoir surface areas, basin slopes, time of concentration and other runnoff characteristics. Elevation/storage relationships for the reservoir were estimated. Surcharge storage was computed assuming the surface area remained constant above the spillway crest. Some of the pertinent hydraulic data was obtained and/or confirmed by actual field measurements at the time of the visual inspection. Test flood values and dam failure profiles were developed in accordance with the Corps of Engineers guidelines. Final values used in this report are quite approximate and are no substitute for actual field analysis.

5.3 Experience Data. Historical data for the operation of this dam is not available. However, discharge data for the Branch River gaging station has been published by the U.S. Geological Survey for the period January, 1940 to the present. The gaging station is located 400 feet downstream from the dam.

5.4 Test Flood Analysis. The recommended guidelines for the Safety Inspection of Dams published by the U.S. Army Corps of Engineers were used for the selection of the Test Flood event. Those guidelines indicate Forestdale Pond Dam to be a SMALL size structure and a SIGNIFICANT hazard. For that classification the guidelines recommended that a range of events from the 100 year recurring frequency to one-half the Probable Maximum Flood (PMF) be considered. The total drainge area is equal to 91.2 square miles of which approximately 10% is swamp or covered by man-made storages. The water-

shed is also sparsely populated, largely wooded and consists of hilly, rolling terrain. Average basin slopes are about 0.003 feet per feet and are judged to be flat. Based on the overall hydrologic parameters this watershed is classified as flat. A test flood equal to one-half the PMF was selected for this analysis, since downstream conditions along the rivers' banks are sparsely populated. The "test flood" was calculated to equal 192 CSM, or 17,500 CFS and was adopted. Outflow discharges developed following the Corps of Engineers criteria were calculated to equal 17,400 CFS. The spillway and outlet works rating curves were developed for this analysis and are illustrated in Appendix D. Flood routings were performed based on an initially full reservoir (pond level at spillway crest level).

The spillway capacity is hydraulically inadequate to pass the "test flood" outflow and overtopping of the dam by 6.6 feet would occur. The maximum spillway capacity of the dam is equal to 5,000 CFS which represents 28.7% of the routed test flood outflow.

At the spillway crest elevation of 199 feet, the capacity of the outlet structure is 246 cfs. It would require one hour to lower the reservoir level one foot. To drain the 160 Ac-Ft. of storage in Forestdale Pond would require one day using the existing outlet works gate, assuming no additional inflow.

5.5 Dam Failure Analysis. An instantaneous full depth - partial width breach of 74 feet was assumed to have occurred in the dam. Assuming the pond level at the top of the dam just prior to failure, the calculated dam failure discharge is equal to 9,500 CFS. This discharge will produce an approximate water surface level of elevation 195 feet immediately below the dam and will raise the water surface 3.0 feet above the level just prior to failure when the discharge is equal to 5,000 cfs. The reach of the river that may be impacted by this dam failure is that portion extending from the dam downstream to the Blackstone River. The analysis assumes the Blackstone River is experiencing normal flow and that there will be no backwater from that stream. For that reach of the river it is estimated that the depth of flow will change from 15 feet at the dam to 12 feet at the Blackstone River. The failure discharge of 9,500 CFS may result in loss of a few lives, property damage to the Forestdale gaging station, the North Smithfield trunk sewer line, Forestdale Bridge #445 (Route 146), and the Branch River Bridge (Route 146 A). Utilities located within the rights-of-way of those roadways can also be temporarily disrupted. It is estimated that the velocity of flow will be high and that the streambanks will sustain severe erosion and stripping and that the debris carried along by the failure wave can result in additional damage and flooding. The dam failure flow also has the potential to undermine the foundations of 1-3 structures (buildings and bridges). The estimated depth of water due to the failure of the dam can range from 1-2 feet at the Forestdale and Branch River Bridges. As a result of this analysis the dam at Forestdale Pond has been classified as a SIGNIFICANT hazard structure.

Forestdale Pond Dam

Inflow, Outflow, and Surcharge Data

FREQUENCY IN YEARS	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR* EFF. RAINFALL IN INCHES	MAXIMUM INFLOW IN C.F.S.	MAXIMUM** OUTFLOW IN C.F.S.	SURCHARGE HEIGHT IN FEET	SURCHARGE STORAGE ELEVATION
½ PMF	11.9	9.5	17,500	17,400	11.6	210.6

= Test Flood

* Infiltration assumed as 0.1"/hour

** Lake assumed initially full at spillway crest elevation 199
(top of dam = 204.00)

NOTES:

1. ½ PMF and "test flood" computation based on COE instructions and guidelines.

2. Maximum capacity of the spillway *without* overtopping the dam (elevation 204.0) is equal to 5000 CFS.

3. All discharges indicated are dependent upon the continued integrity of upstream storage reservoirs.

4. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.

5. Test flood = one-half PMF = 192 CSM = 17,500 CFS
(D.A. = 91.2 square miles).

Forestdale Pond Dam

Inflow, Outflow, and Surcharge Data

FREQUENCY IN YEARS	24-HOUR TOTAL RAINFALL IN INCHES	24-HOUR* EFF. RAINFALL IN INCHES	MAXIMUM INFLOW IN C.F.S.	MAXIMUM** OUTFLOW IN C.F.S.	SURCHARGE HEIGHT IN FEET	SURCHARGE STORAGE ELEVATION
½ PMF	11.9	9.5	17,500	17,000	12.54	210.54

= Test Flood

* Infiltration assumed as 0.1"/hour

** Lake assumed initially full at spillway crest elevation 199
(top of dam = 204.00)

NOTES:

1. ½ PMF and "test flood" computation based on COE instructions and guidelines.

2. Maximum capacity of the spillway without overtopping the dam (elevation 204.0) is equal to 5000 CFS.

3. All discharges indicated are dependent upon the continued integrity of upstream storage reservoirs.

4. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.

5. Test flood = one-half PMF = 192 CSM = 17,500 CFS
(D.A. = 91.2 square miles).

SECTION 6

EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation. The visual observations did not disclose any indications of instability of the dam. However, the following features could adversely affect the future performance of the dam:

1. Continued deterioration of the remnant powerhouse could lead to further structural failure of the building with the effect of releasing water around the left abutment of the dam.

2. Trees growing from the upstream stone masonry retaining wall and from beneath the rightmost pier on the dam crest will result in further deterioration of the dam.

6.2 Design and Construction Data. An 1883 Report of the Commissioner of Dams and Reservoirs indicates that the stone masonry blocks were hammer dressed, laid in continuous courses and cemented and that the dam is on a bedrock foundation. Except at the right abutment, a bedrock foundation could not be confirmed during the visual inspection.

6.3 Post-Construction Changes. A 1928 Report of the Commissioner of Dams and Reservoirs indicates that new concrete gates were installed in the dam in 1923.

6.4 Seismic Stability. The dam is located in Seismic Zone 2 and according to the Phase I inspection guidelines does not warrant seismic stability analysis.

SECTION 7

ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

7.1 Dam Assessment.

a. Condition. Based on the visual inspection and review of available information, the dam appears to be in poor condition, as evidenced by the following:

1. Extensive flow through the headrace gates and turbines of the razed powerhouse adjacent to the dam.

2. Inadequate capacity of the dam to pass the test flood outflow without overtopping of the dam.

3. Leaking and flow observed at the right abutment.

4. Inoperable draw-off gate for regulating the impoundment level for repairs and maintenance.

b. Adequacy of Information. The information available is such that the assessment of the safety of the dam must be based on the visual inspection.

c. Urgency. The recommendations and remedial measures described below should be implemented within one year after receipt of this Phase I inspection report by the Owner.

7.2 Recommendations

The following should be accomplished under the direction of a qualified registered engineer and any recommendations resulting be implemented by the Owner:

1. The sources and paths of seepage through the remnants of the powerhouse, intake gates and downstream stone masonry retaining walls should be investigated in more detail to determine their potential effects on the structural stability of the dam.

2. All trees growing from the stone masonry walls should be removed, the stone blocks reset, and voids filled with stone of the proper size.

3. The downstream face and toe of the dam should be inspected for erosion or undermining when there is no flow over the spillway.

4. The maximum discharge capacity of the dam is not considered adequate. Further hydrologic studies are warranted to improve the discharge capabilities of the dam and reduce the overtopping potential.

5. A detailed evaluation of the dam and abandoned powerhouse structure should be undertaken to define more accurately the exact condition and physical features of the facility.

7.3 Remedial Measures

a. Operation and Maintenance Procedures.

1. A program of annual technical inspections by a qualified, registered engineer should be instituted.

2. Rehabilitate the draw-off gate.

3. Develop an "Emergency Action Plan" that will include an effective preplanned warning system, action to be taken at other reservoirs, locations of emergency equipment, material and manpower, authorities to be contacted, potential areas that require warning or evacuation and dewatering procedures to be followed. The Owner should also provide surveillance of the dam during intense rainfall.

4. Repair all spalled and deteriorated concrete and rebuild the walkway over dam.

7.4 Alternatives

Removal of the dam is a viable alternative to the above recommendations for the dam.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Forestdale Pond Dam DATE November 6, 1979

TIME _____

WEATHER Cloudy

W.S.ELEV. 199.2 U.S. _____ D.S.

PARTY:

1. A. Reed, CEM
2. L. Topp, CEM
3. E. Dessert, CEM
4. G. Castro, GEI
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

PERIODIC INSPECTION CHECK LIST

PROJECT Forestdale Pond Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	199.0
Current Pool Elevation	199.2
Maximum Impoundment to Date	Unknown
Surface Cracks	Not observable.
Movement or Settlement of Crest	None observed.
Lateral Movement	None observed.
Vertical Alignment	Good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Seepage through both abutments.
Sloughing or Erosion of Slopes or Abutments	None observed.
Unusual Movement or Cracking at or Near Toe	Unobservable
Unusual Embankment or Downstream Seepage	Unobservable
Piping or Boils	None observed.
Foundation Drainage Features	None known or observable.
Toe Drains	None known or observable.
Instrumentation System	Any instrumentation hydro-electric; destroyed during fire.
Vegetation	Several trees at either abutment and at right downstream face.

PERIODIC INSPECTION CHECK LIST

PROJECT Forestdale Pond Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Forebay for powerhouse.
Slope Conditions	Stone masonry and concrete cap retaining walls in fair condition.
Bottom Conditions	Not observable.
Rock Slides or Falls	None
Log Boom	Trash rack; poor condition, blocked with debris.
Debris	Clogged debris in trash rack.
Drains or Weep Holes	None observed.
b. Intake Structure	Part of remnant powerhouse, partially in place.

PERIODIC INSPECTION CHECK LIST

PROJECT Forestdale Pond Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	Adjacent mill complex housed hydro-electric plant, connected via gated headrace. Mill was totally destroyed by fire.
General Condition of Concrete	Poor
Rust or Staining	None observed.
Spalling	Severe
Erosion or Cavitation	None observed.
Visible Reinforcing	None observed.
Any Seepage or Efflorescence	None observed.
Condition at Joints	Poor
Drain Holes	None observed.
Channel	Discharges enter river slightly downstream of spillway toe and through base of mill (powerhouse)
Loose Rock or Trees Overhanging Channel	None observed.
Condition of Discharge Channel	Natural river channel.

PERIODIC INSPECTION CHECK LIST

PROJECT Forestdale Pond Dam DATE November 6, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	Natural river bed.
General Condition	Good
Loose Rock Overhanging Channel	None observed.
Trees Overhanging Channel	Trees along river edge.
Floor of Approach Channel	Natural bottom.
b. Weir and Training Walls	Training wall at left abutment, granite masonry with concrete cap.
General Condition of Concrete	Weir not observable. Flashboards.
Rust or Staining	Unobservable
Spalling	None observed.
Any Visible Reinforcing	None observed.
Any Seepage or Efflorescence	Seepage observed at left and right abutments.
Drain Holes	None observed.
c. Discharge Channel	Natural river channel.
General Condition	Good
Loose Rock Overhanging Channel	None observed.
Trees Overhanging Channel	Few
Floor of Channel	Not observable.
Other Obstructions	None observable.

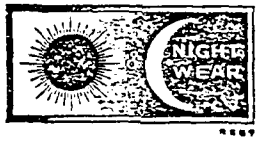
Branch #5

William Hollins & Company, Inc.

Forestdale, Rhode Island

New York - Nottingham - London - Glasgow Toronto - Melbourne

Manufacturers and Importers of "Viyella" and "Clydella" Fabrics and Hosiery



Please address reply to Forestdale, R. I.

Telephone: Woonsocket 732

"Viyella House" Products

RECEIVED
Mch 31 39
ANSWERED

March 30, 1939

Department of Public Works
Division of Harbors & Rivers
State Office Building
Providence, R. I.

Dear Sirs:

In reply to your form inquiry of March 27th, we list below two individuals, either of whom should be contacted in case of emergency:

R. L. English Tel. Woon. 856-W
321 Carrington Ave.
Woonsocket, R. I.

W. T. Rigby Tel. Woon. 4227-R
181 Great Road, Union Village
Woonsocket, R. I.

We regret that we have no blue prints of our dam which can be forwarded to you. The dam was built so long ago that we cannot furnish you with any data pertaining to its origin or construction details.

Yours very truly,
WILLIAM HOLLINS & COMPANY, INC.

R L English

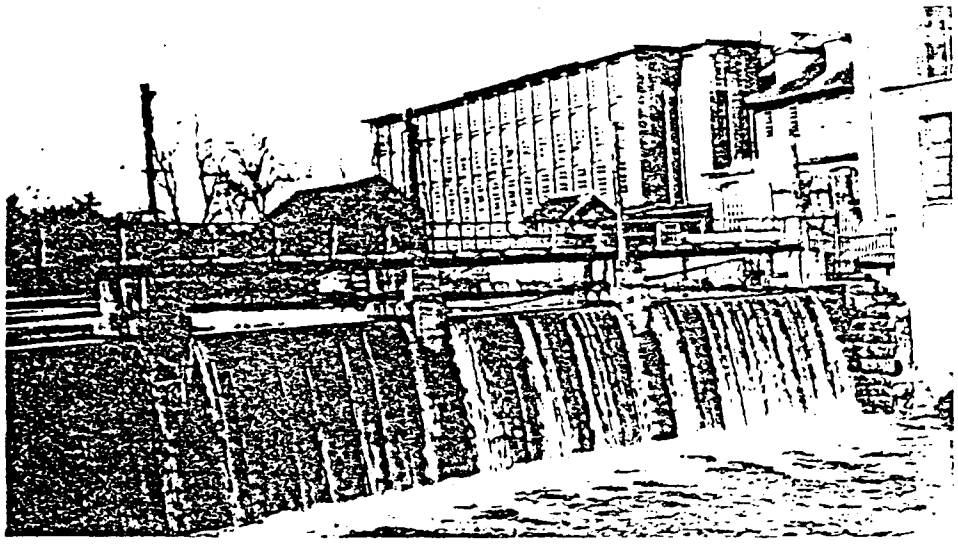
RLE:LS

COPY OF FULL REPORT AS CONTAINED IN YEARLY REPORTS

OF COMMISSIONERS OF DAMS AND RESERVOIRS

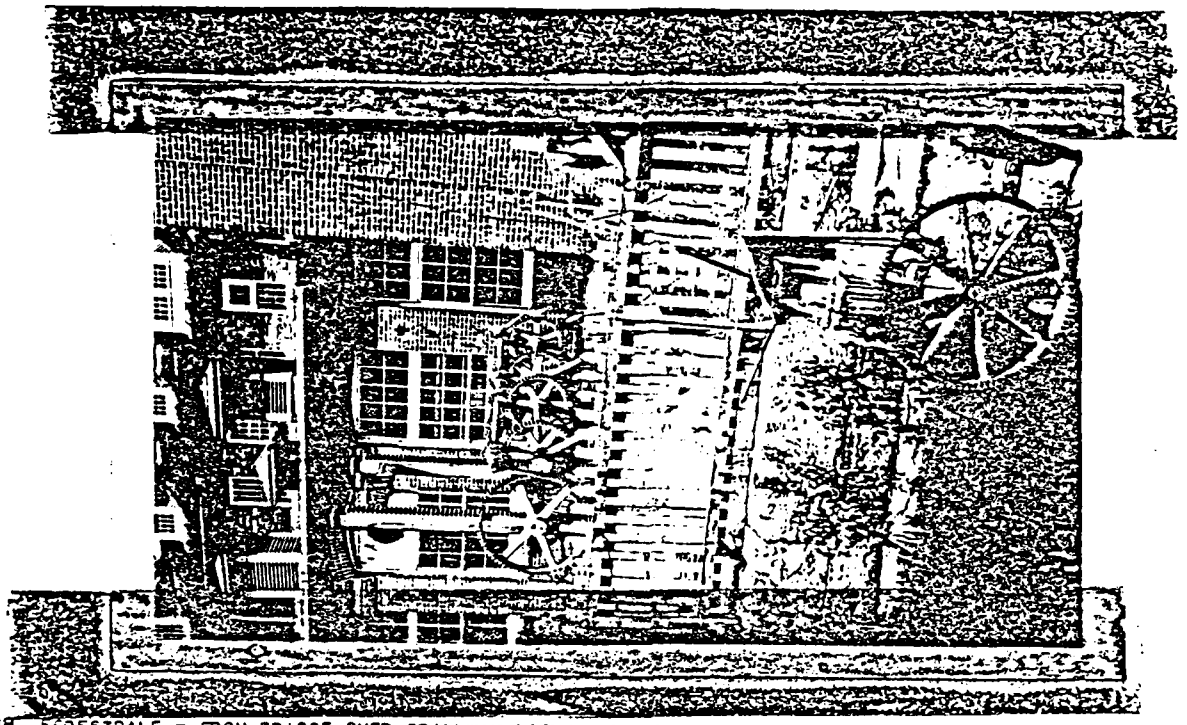
1883 - P 52 Dam 100 feet long on ledge foundation and built of stone with hammer dressed beds and joints, laid in continuous courses and cemented. The rollway extends the whole length of the dam. The privilege has a fall of 14 feet. This dam may be reckoned as among dams of the first class.

1928 - P 33 New concrete gates were installed at this dam in 1923. Plans of the work were not filed with this office. The waste gate is 3'x4' and there are two 5'x5' gates to the trench leading to the wheel. The masonry spillway appears to be in good condition. Twelve-inch flash boards are ordinarily carried on the dam during the high water of 1927.

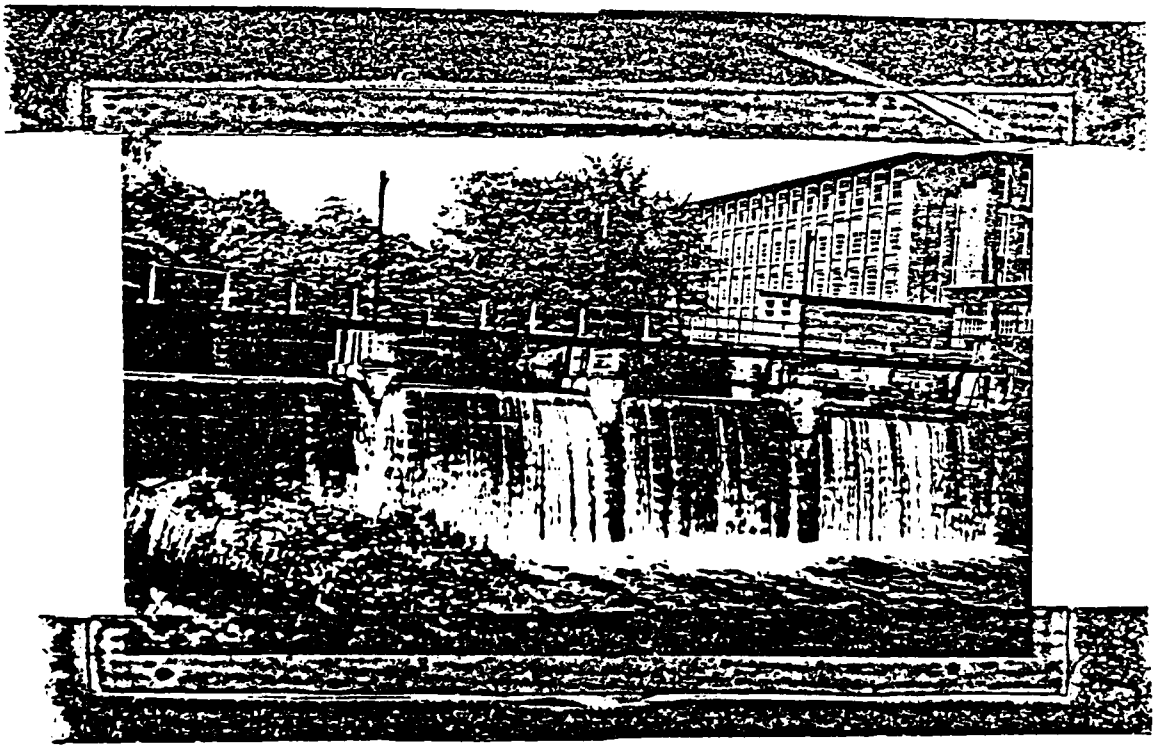


#48

~~Br-51~~-FORESTDALE SPILLWAY Feb. 17, 1941.



48 FORESTDALE - FROM BRIDGE OVER SPILLWAY LOOKING NORTH - SHOW WHEEL TO DRAW-OFF GATE IN FOREGROUND AND WHEELS TO OPERATE 3 GATES TO MILL (1 UP) AT REAR. 7/25/47



48 FORESTDALE - FROM BELOW FALLS LOOKING AT SPILLWAY WITH 2 FLASH-BOARDS IN PLACE TO-DAY. 7/25/47

R. I. DEPARTMENT OF PUBLIC WORKS
DIVISION OF HARBORS & RIVERS

SPECIAL INSPECTION REPORT

DATE: 9/20/45

INSPECTED BY: [illegible] Blanchette

DAM NO. 48 NAME Forestdale

TOWN OR CITY ON BROCK RIVER TRENCH WATERSHED

OWNER Wm Hollins Co ADDRESS Forestdale R.I. Mill Tel Nor 732-

REPORT ON

NEW CONSTRUCTION PLANS BY:

REPAIRS PERMIT GRANTED:

INSPECTION ONLY CONTRACTOR:

1. Jack Blanchette M.M. 22 Main St, Forestdale Res Nor 1211 W
2. Robt. English Supt Meadow Mean Milford 2136 M

INSPECTION REPORT: condition - good

Masonry granite curved spillway later heavy granite abutments spans river and rests on ledge. 20" permanent wooden flash in place with 13" flashboard above supported with iron pins. Water over entire section to-day. Wheels not operating - ordinarily 2 large water wheels utilize all available water for this.

Draw - 1 gate at N. end of spillway - not operating - frame rotted out. One pier on crest of dam needs facing with concrete.

2 large gates to trench + water wheels in good working condition

Dam under constant attention of Mill workmen - Mill in full operation - Burying power which runs low - generally operate wheels for 9 mos. of year

2 large gates - on trench (10 x 12'?)

2 Wheels - 200 H.P. each - Type "Z" Vert. Turbine by Leffel + Co Springfield Ohio

can be blocked for flood discharge

R. I. DEPARTMENT OF PUBLIC WORKS
DIVISION OF HARBORS AND RIVERS

SPECIAL INSPECTION REPORT

DAM NO. 48

INSPECTED BY JOHN V. KEILY
BLANCHETTE

TOWN - NORTH SMITHFIELD

DAM NO. 48 NAME FORESTDALE ON ~~ESSEX~~ RIVER BRANCH RIVER

WATERSHED BLACKSTONE

OWNER WILLIAM HOLLIN S COMPANY

ADDRESS FORESTDALE, R. I. MILL TEL. WOON. 732

REPORT ON—NEW CONSTRUCTION REPAIRS INSPECTION ONLY x

PLANS BY APPROVED CONTRACTOR

INSPECTION REPORT BY JOHN V. KEILY REASON ROUTINE DATE 9/20/46

TICKLER

SPILLWAY

TYPE

CONDITION

DRAW-OFF GATES

NUMBER

CONDITION

TRENCHES & WHEELS

EMBANKMENT

TYPE

CONDITION

APPROACHES

EROSION

BRUSHES & TREES

RIPRAP

PRESENT USE

WHO CONTROLS

WHO CONTACTED AT SITE

INSTRUCTIONS LEFT

IN EMERGENCY CALL

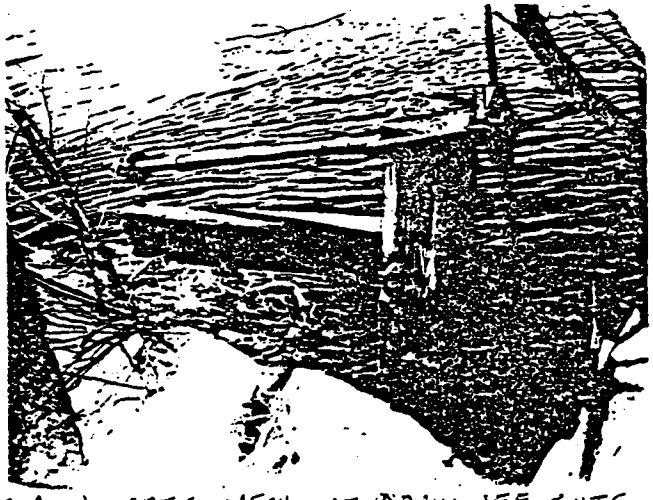
EMERGENCY CALL:

1. JACK BLANCHETTE, MASTER MECHANIC, 22 MAIN ST., FORESTDALE, TEL. RES. WOON 1211-W
2. ROBERT ENGLISH, SUPT., MENDON, MASS., TEL. MILFORD 2136-WK

9/20/46 CONDITION GOOD. MASSIVE GRANITE CURVED SPILLWAY BETWEEN HEAVY GRANITE ABUTMENTS SPANS RIVER AND RESTS ON LEDGE. 20" PERMANENT WOODEN FLASH BOARDS IN PLACE WITH 13" LIGHTER BOARD ABOVE (SUPPORTED WITH IRON PINS). WATER OVER CENTER SECTION TO-DAY. WHEELS NOT OPERATING; ORDINARILY 2 LARGE WATER WHEELS UTILIZE ALL AVAILABLE WATER (SEE BELOW). DRAW-OFF GATE AT NORTH END OF SPILLWAY (NOT OPERATING) FRAME ROTTED OUT. ONE PIER ON CREST OF DAM NEEDS FACING WITH CONCRETE. 2 LARGER GATES TO TRENCH AND WATER WHEELS IN GOOD CONDITION. DAM UNDER CONSTANT ATTENTION BY MILL WORKERS. MILL IN FULL OPERATION, BUYING POWER WHILE RIVER IS LOW; GENERALLY OPERATES WHEELS FOR 9 MONTHS OF YEAR. 2 LARGE GATES ON TRENCH (EACH 10' x 7.5') FEED TWO WHEELS-200 HP EACH- TYPE "Z" VERTICAL TURBINE, JOS. LEFFEL & CO., SPRINGFIELD, OHIO, CAN BE BLOCKED FOR FLOOD DISCHARGE.

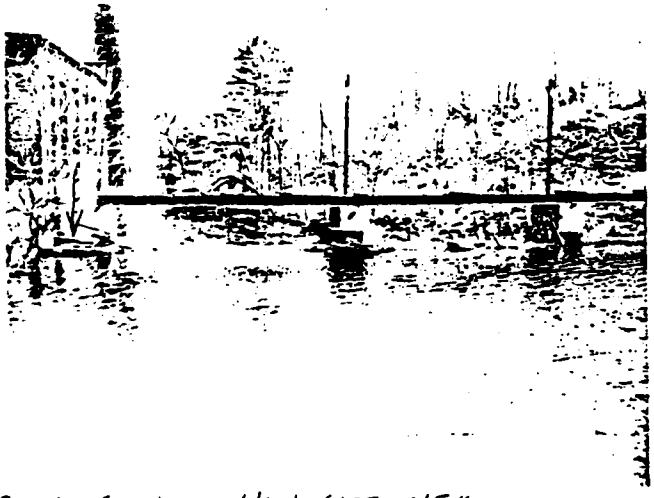
7/25/47 MASTER MECHANIC EXPECTS TO REPAIR CONCRETE ON PIERS SHORTLY.

PHOTO #1 DAM #48



MAIN GATE MECH. AT DRAW-OFF GATE

PHOTO #2 DAM #48



ARROW SHOWING MAIN GATE MECH.

PHOTO #3 DAM #48

ROTTING TIMBERS @ MAIN SPILLWAY

DEPARTMENT OF NATURAL RESOURCES

DAM INSPECTION REPORT

DAM: 48 RIVER: Branch WATERSHED: Blackstone/ BRANCH RIVER

NAME: Forestdale Pond Dam TOWN: N. Smithfield

OWNER:

Robert N. Meunier
P. O. Box 451
Lake Road
Newport, Vermont

REPORT ON: General Condition

REASON FOR INSPECTION: N.P.S.I.D. HighHazard/Small
Annual Inspection

INSPECTION BY:

Earle Prout
Carmine Asprinio

DATE OF INSPECTION: April 6, 1978

REPORT: Existing Conditions:

Gates to penstock for mill show no signs of damage or vandalism and, except for need of lubrication, appear to be in operating condition.

Mill itself is completely burned out and abandoned.

Some water passing between blocks is visible at face of spillway.

Gate mechanism at draw-off gate completely inoperable. (see photo 1)

Walkway over crest of spillway no longer exists, thereby making use of former flashboards impossible. (see photo 3)

Concrete at abutments and gates show very little signs of scouring (except on south abutment)

No obvious signs of damage or irregularities along crest of spillway.

No leakage or erosion of earth bank visible on south side of spillway.

Comments

Letter to owner advising him of his responsibilities to keep dam in safe, operable condition and request he repair draw-off gate mechanism.

DIVISION OF HARBORS AND RIVERS

SURVEY OF DAMS IN RHODE ISLAND

Branch River Basin — #48 Forestdale

Drainage Area 95.5 Sq. Mi.

Spillway 90 ft. long, after allowing for contractions, by 5.5 ft. deep	Capacity	5003	c.f.s.
Gate 3' x 4'	"	317	"
Wheels	"	300	"
Total	"	5620	c.f.s.*

February 1948

Estimated Extreme Freshet 5921 c.f.s.

*Storage in Slatersville ponds will reduce the freshet discharge at Forestdale.

FEBRUARY 1948

FORESTDALE — RIVER BASIN — DAM NO. 48

TOWN	ROAD	STREAM	OWNER OR OPERATOR	TELEPHONE
NO. SMITH S		BRANCH R.	WILLIAM HOLL NS CO. C/O JACK DEATHERAGE MASTER MECHANIC	YOEN 732

REPORT	PLANS	L	DR. AREA	EXTR. FRESHET	TOTAL CAP. OF DISCHARGE	INSP.	CONDIT.
			95.5 SQ. MI.	5921 C.F.S.	5620 C.F.S.		

SIGNIFICANT INFORMATION

1883-52	1928-33	R	1928 - NEW CONCRETE GATES	1946	GOOD
1928-33	WPA-848	V			

SEE VERTICAL FILES FOR DETAILS

DIVISION OF HARBORS AND RIVERS
SURVEY OF STATE DAMS. #48

Branch River Valley. ~~#61~~ Forestdale.

Drainage area at the dam 95.49 sq. mi.
Estimated extreme freshet, 6130 cfs.

Spillway, 90 ft. long after allowing for contractions, by 5.5 ft. deep	----- capacity	----------	5003 cfs.	5003
3'x4' → Gate 4 ft. by 4.5 ft.	---------- "	----------	~~317~~ "	317
out 1917 Wheels	---------- "	----------	700 "	300
	Total "	----------	~~6165~~ "	5620 cfs

Note - Storage in Flatwoods ponds will reduce the amount of freshet water to be discharged at Forestdale.

March 19, 1941.

APPENDIX B-2

SELECTED COPIES OF PAST INSPECTION REPORTS

APPENDIX B-1

Correspondence pertaining to the history, maintenance, and modifications to the Forestdale Pond Dam as well as copies of past inspection reports are located at:

Department of Environmental Management
State of Rhode Island
83 Park Street
Providence, Rhode Island
Department of Land Resources - Dam Section

APPENDIX B

ENGINEERING DATA

State of Rhode Island and Providence Plantations

DEPARTMENT OF PUBLIC WORKS
STATE OFFICE BUILDING

Frederick V. Waterman
DIRECTOR

OFFICE OF THE DIRECTOR

DIVISION OF ROADS AND BRIDGES
DIVISION OF PUBLIC BUILDINGS
DIVISION OF STATE AIRPORTS
DIVISION OF HARBORS AND RIVERS

DIVISION OF HARBORS & RIVERS

PROVIDENCE. March 27, 1939

William Hollins & Company
Main Street
No. Smithfield, R. I.

Dear Sir:-

Will you kindly furnish this office with any data or plans you may have; also the name, address and telephone number, if any, of the person in charge of the Viyella Mill dam or gates located on the Branch River at Forestdale, No. Smithfield, R. I. in order that we may notify him in case of any emergency.

Kindly return this letter with the information thereon as a means of identification.

If possible, also furnish us with date when said dam or gates were built or rebuilt.

Very truly yours,

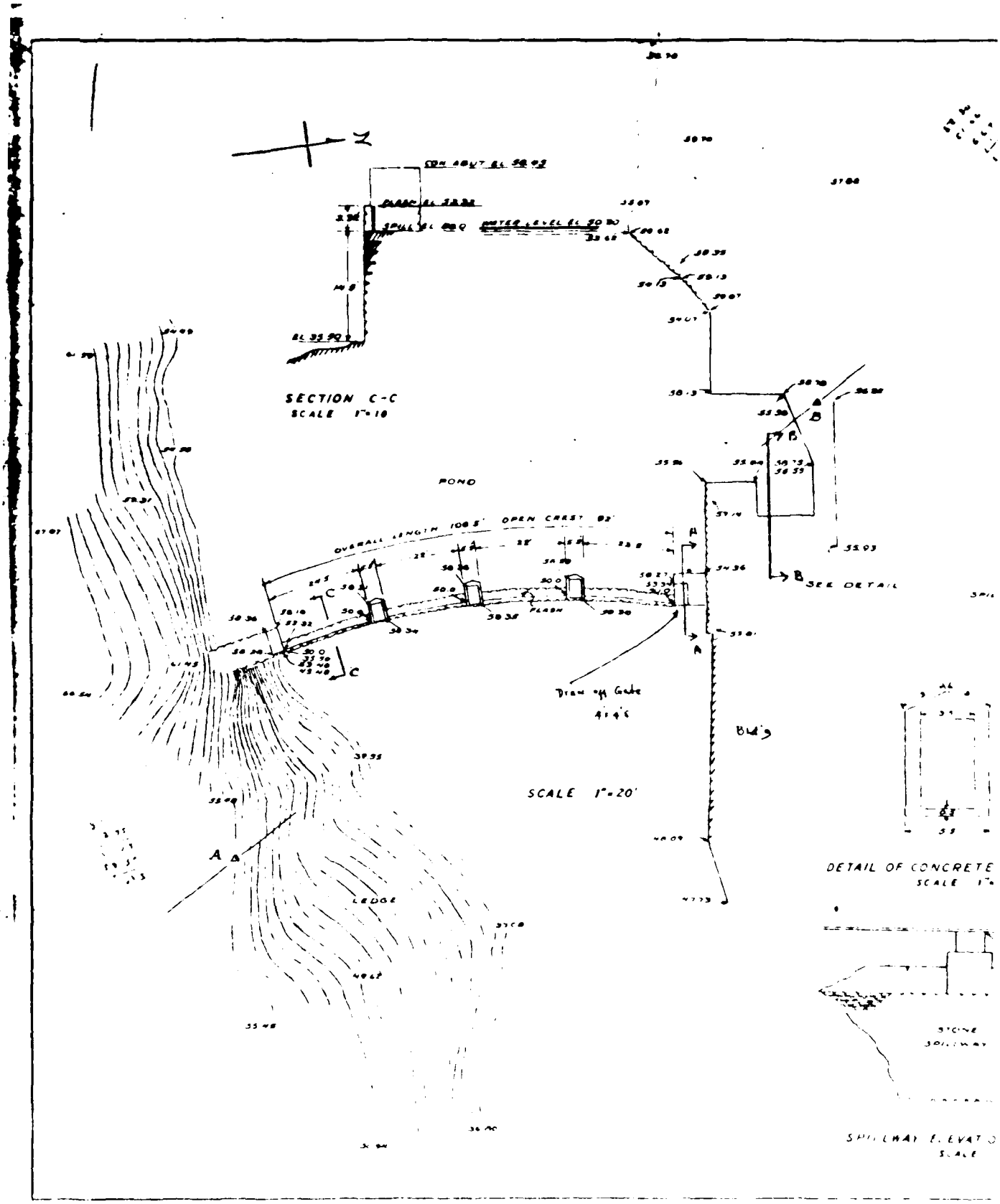
R. Robert Rynch.

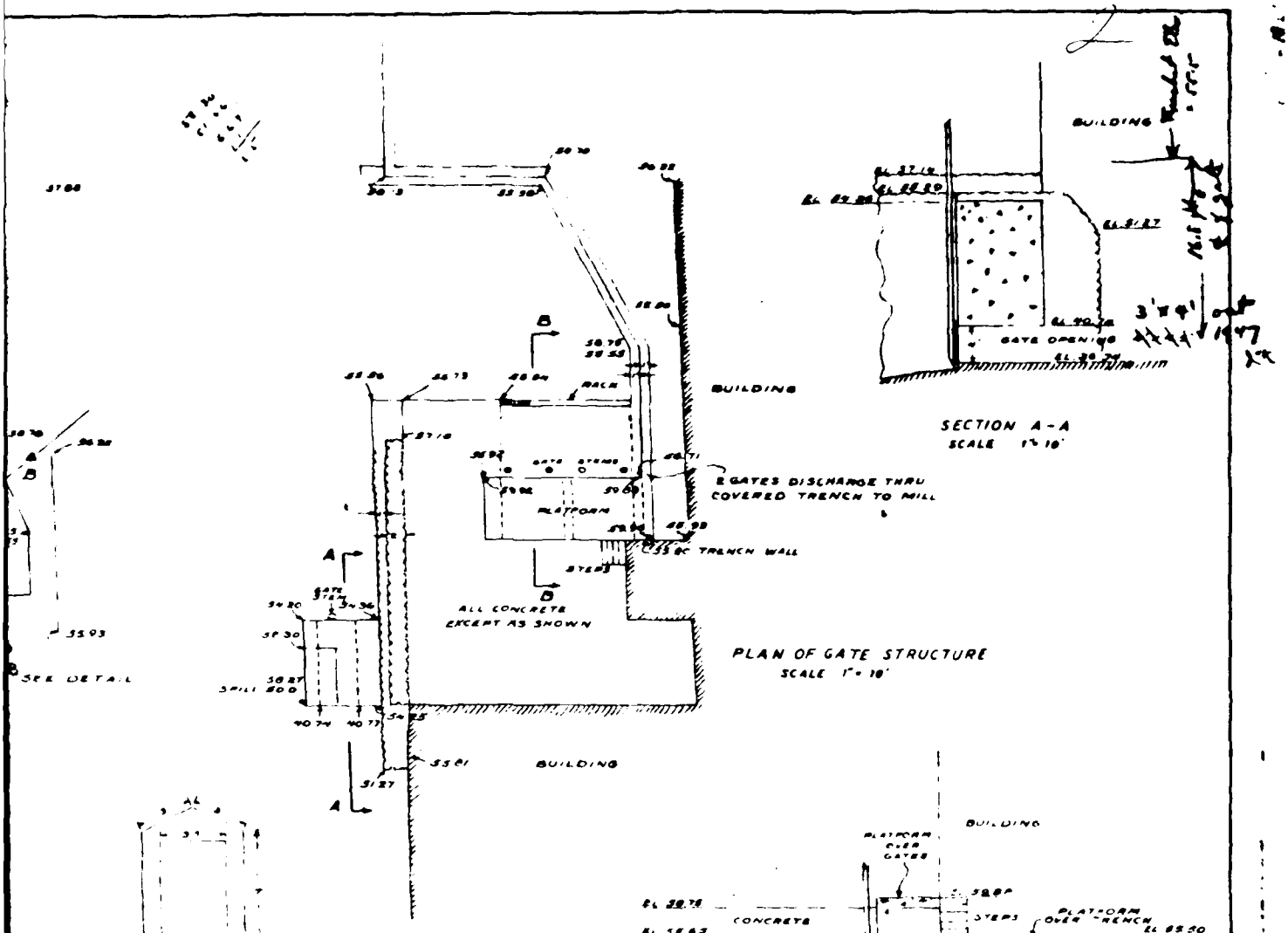
CRL/T

CHIEF DIVISION HARBORS & RIVERS.

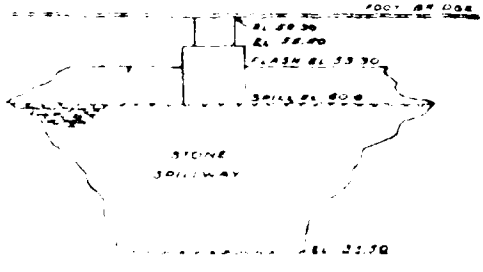
APPENDIX B-3

PLANS, SECTIONS, DETAILS


SECTION C-C
SCALE 1"=10'
POND
OVERALL LENGTH 108.5' OPEN CREST 82'
SEE DETAIL
Drain off Gate
SCALE 1"=20'
LEDGE
DETAIL OF CONCRETE
STONE
SPILLWAY



DETAIL OF CONCRETE PIER ON SPILL
SCALE 1"=5'



SPILLWAY ELEVATION FROM DOWNSTREAM
SCALE 1"=10'

PHOTO REDUCED
NOT TO SCALE

48

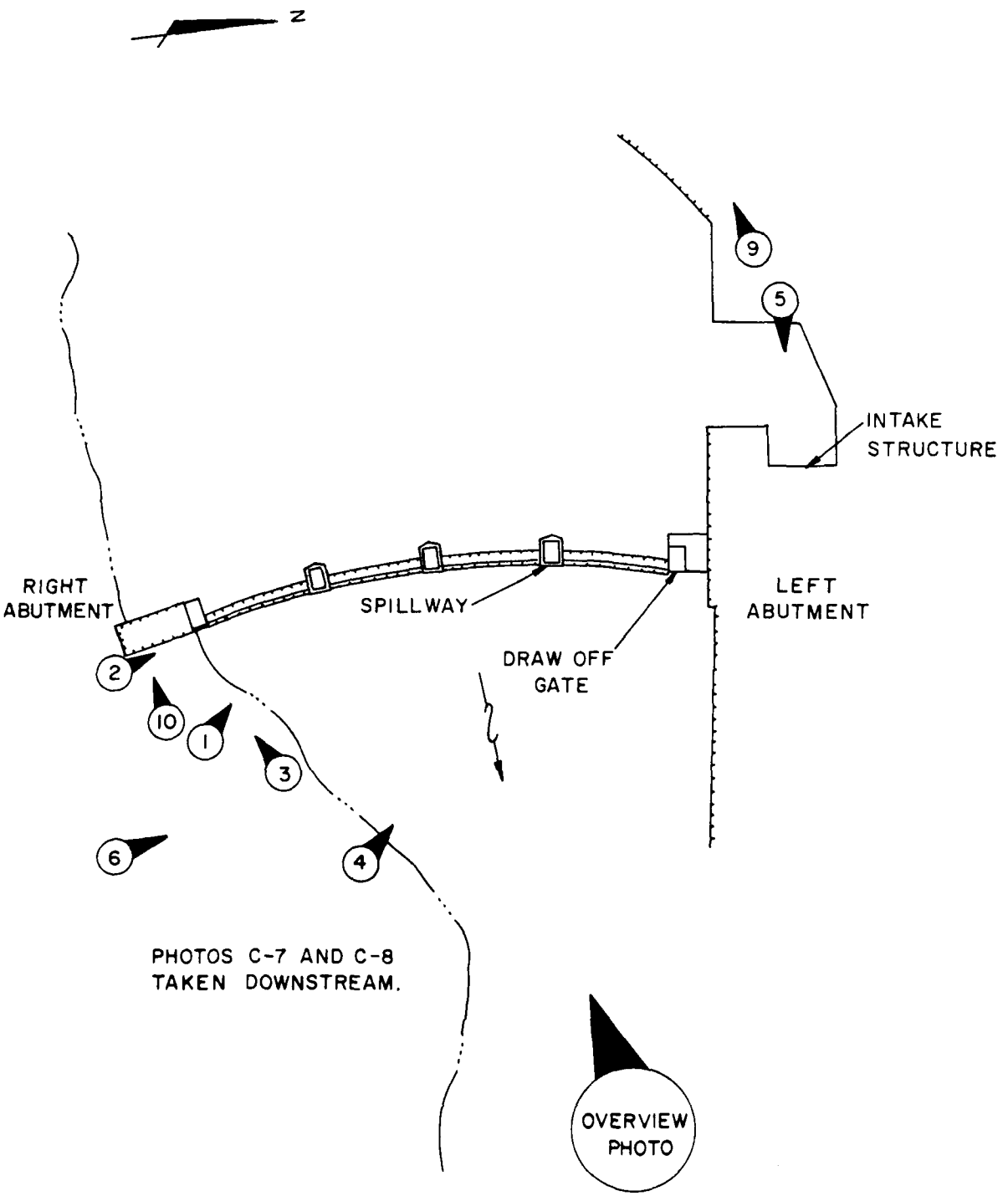
51 FORESTDALE

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF WATERSHED & FLOOD PREVENTION
BY THE
SOIL CONSERVATION SERVICE

DATE 3-4-41 | PLAN NO. B-51

APPENDIX C

PHOTOGRAPHS



FORESTDALE POND DAM
PHOTO INDEX

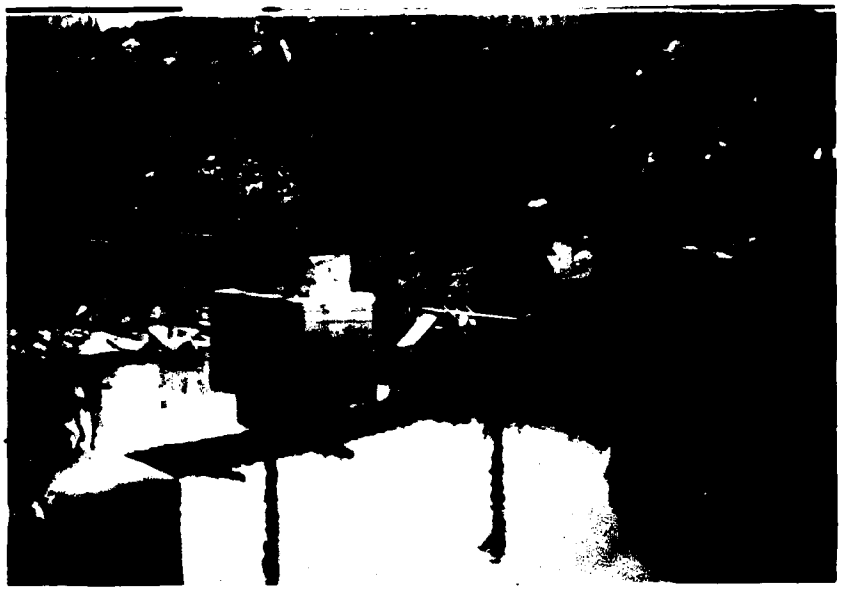


PHOTO C-1 Upstream face of dam at overflow Weir Section

PHOTO C-2 Downstream face of dam looking from right abutment.

PHOTO C-3 Downstream face of right abutment of dam.

PHOTO C-4 Left abutment of dam at former mill structure.

PHOTO C-5 Intake gates to mill used for power generation.

PHOTO C-6 Portion of mill remaining adjacent to river. Note some flow through building exit near stack.

PHOTO C-7 Downstream channel below dam.

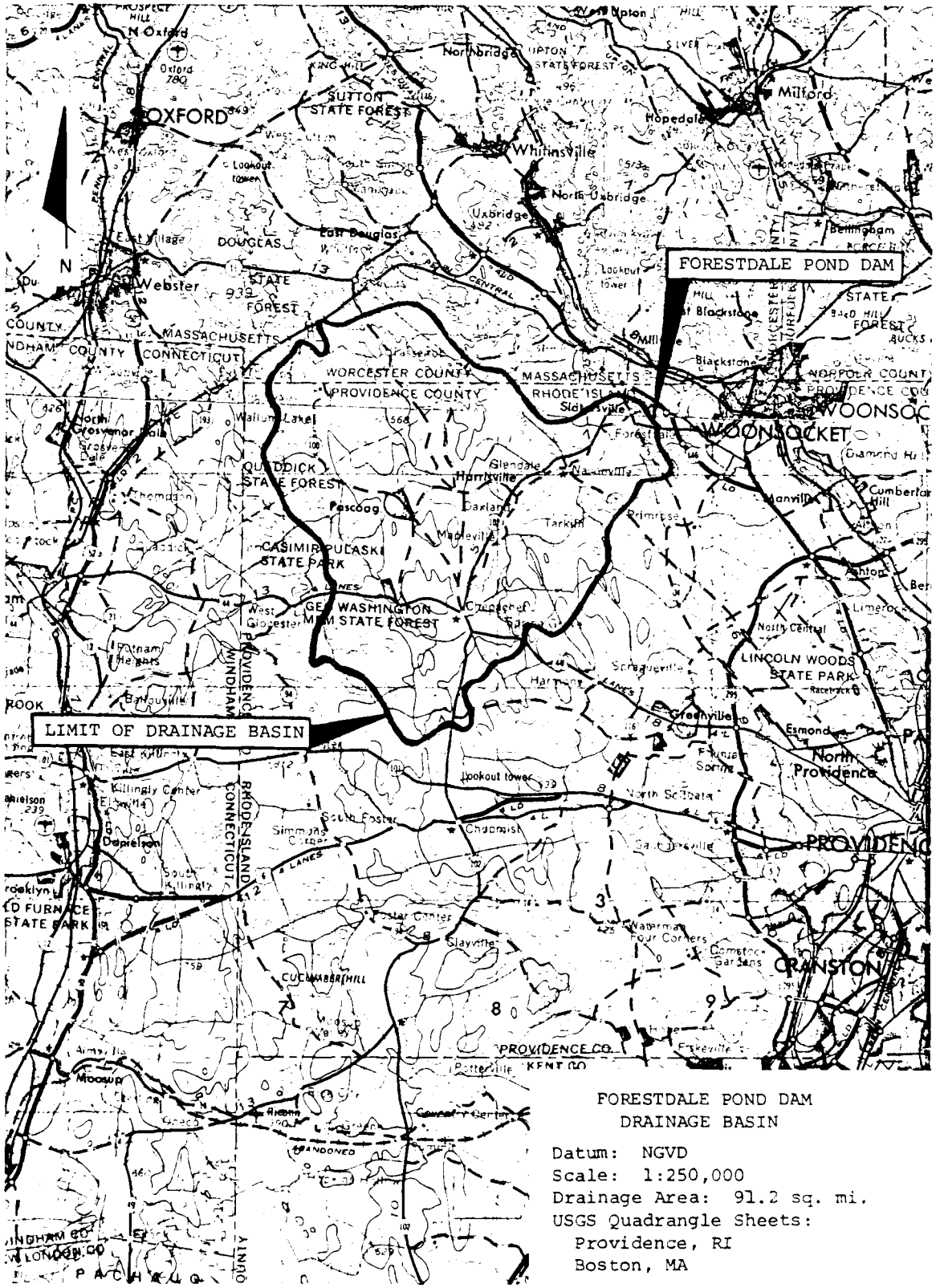
PHOTO C-8 Sewer crossing in Photo C-7.

PHOTO C-9 Upstream Reservoir impounded by dam.

PHOTO C-10 Seepage around right abutment.

APPENDIX D

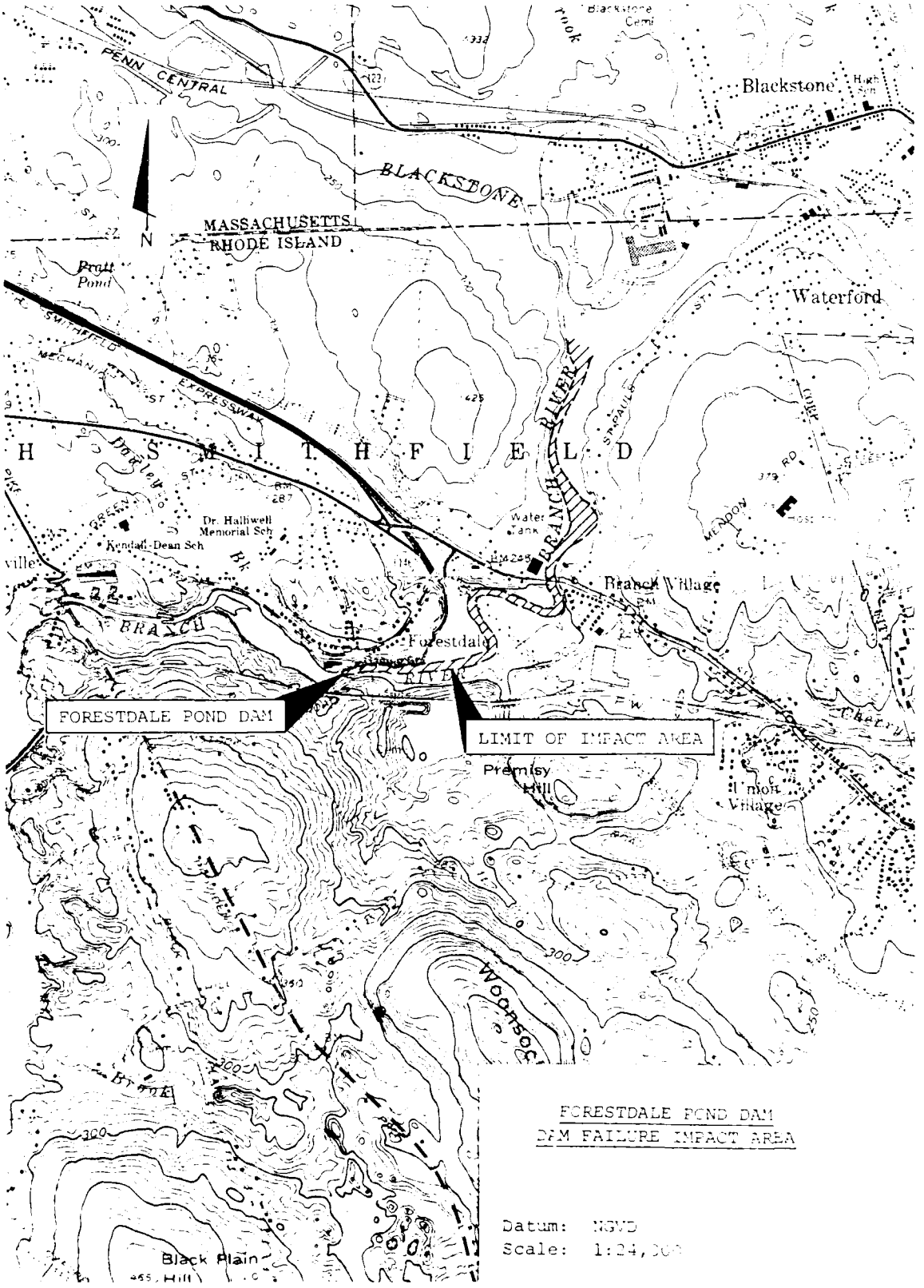
HYDROLOGIC AND HYDRAULIC COMPUTATIONS



FORESTDALE POND DAM
DRAINAGE BASIN

Datum: NGVD
Scale: 1:250,000
Drainage Area: 91.2 sq. mi.
USGS Quadrangle Sheets:
Providence, RI
Boston, MA

PLATE D-1



FORESTDALE POND DAM
DAM FAILURE IMPACT AREA

Datum: NGVD
Scale: 1:24,000

Plate No. D-1a

Estimating Maximum Probable Discharges - Inflow and Outflow Values Date of Inspection: November 6, 1979

Name of Dam Forestdale Pond Dam ; Location of Dam Branch River ; Town North Smithfield

Watershed Characterization Hilly terrain scattered with swamps, lakes, reservoirs; 10% of drainage area is swampy or occupied by storage reservoirs

Adopted "test" flood = Half PMF = 192 CSM = 17500 CFS; Re = Effective Rainfall = 9.5 inches

D.A. = Drainage Area (Gross) = 91. Square Miles; Basin Slope = 0.003 ft/ft hence; flat

S.A. = Surface Area of Reservoir = 0.031 Square Miles; Time of Concentration = more than 20 hours

Shape and Type of Spillway = overflow, vertical fall weir

B = Width of Spillway = Effective" = 92.0 feet Gross Length = 108.5 ft, C = Coefficient of Discharge = (3.8-Friction) = 3.70

D-3

Maximum Capacity of Spillway Without Overtopping = 5000 CFS = 28.7 % of test flood

Top of Dam Elevation = 204.0 ; Spillway Crest Elevation = 199.0

Overflow portion of Length of Dam = - - - ; C = Coefficient of discharge for Dam = - - -

Name of Dam	Test Flood Q_p CSM	Test Flood Q_p CFS	Inflow Characteristics h_0 in feet	Inflow Characteristics S_0 in in.	Outflow Characteristics First Approximation Q_{p1} CFS	h_1 in ft.	S_1 in in.	Outflow Characteristics Second Approximation S_2 in in.	h_2 in ft.	Q_{p2} CFS	Outflow Characteristics Third Approximation (Adopted) S_3 in in.	h_3 in ft.	Q_{p3} CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Forestdale Pond Dam	100 year = 83.3	7600	7.91	0.035	-	-	-	-	-	-	0.03	7.64	7200
	½PMF = 192	17500	13.80	0.06	-	SEE	PLATE	D-11	-	-	0.047	11.6	17400

Q_p = Discharge; h = Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

A. Size Classification

Height of dam = 19.5 ft.; hence SMALL

Storage capacity at top of dam (elev. 204.0) = 260 AC-FT.; hence SMALL

Adopted size classification SMALL

B. Hazard Potential

The dam is classified as having a SIGNIFICANT hazard potential because its failure may result in loss of a few lives, damage to the Branch River gaging station, the North Smithfield trunk sanitary sewer main, Forestdale Bridge #445 (Route 146), Branch River Bridge #108 (Route 146A) and a utility crossing and mill building adjacent to the roadway. Water depths may range from 15 feet immediately downstream of the dam to 12 feet at the confluence of the Branch and Blackstone Rivers. Velocities of flow are estimated to be high. Debris from river banks will be carried along, causing increased damage from impact and flooding.

C. Adopted Classifications

HAZARD	SIZE	TEST FLOOD RANGE
SIGNIFICANT	SMALL	100 year to Half PMF

Adopted Test Flood = Half PMF = 192 CSM

= 17500 CFS

D. Overtopping Potential

Drainage Area 91.2 = 91.2 sq. miles

Spillway crest elevation = 199.0 NGVD

Top of Dam Elevation = 204.0 NGVD

Maximum spillway discharge Capacity without overtopping of dam = 5000 CFS

"test flood" inflow discharge = 17500 CFS

"test flood" outflow discharge = 17400 CFS

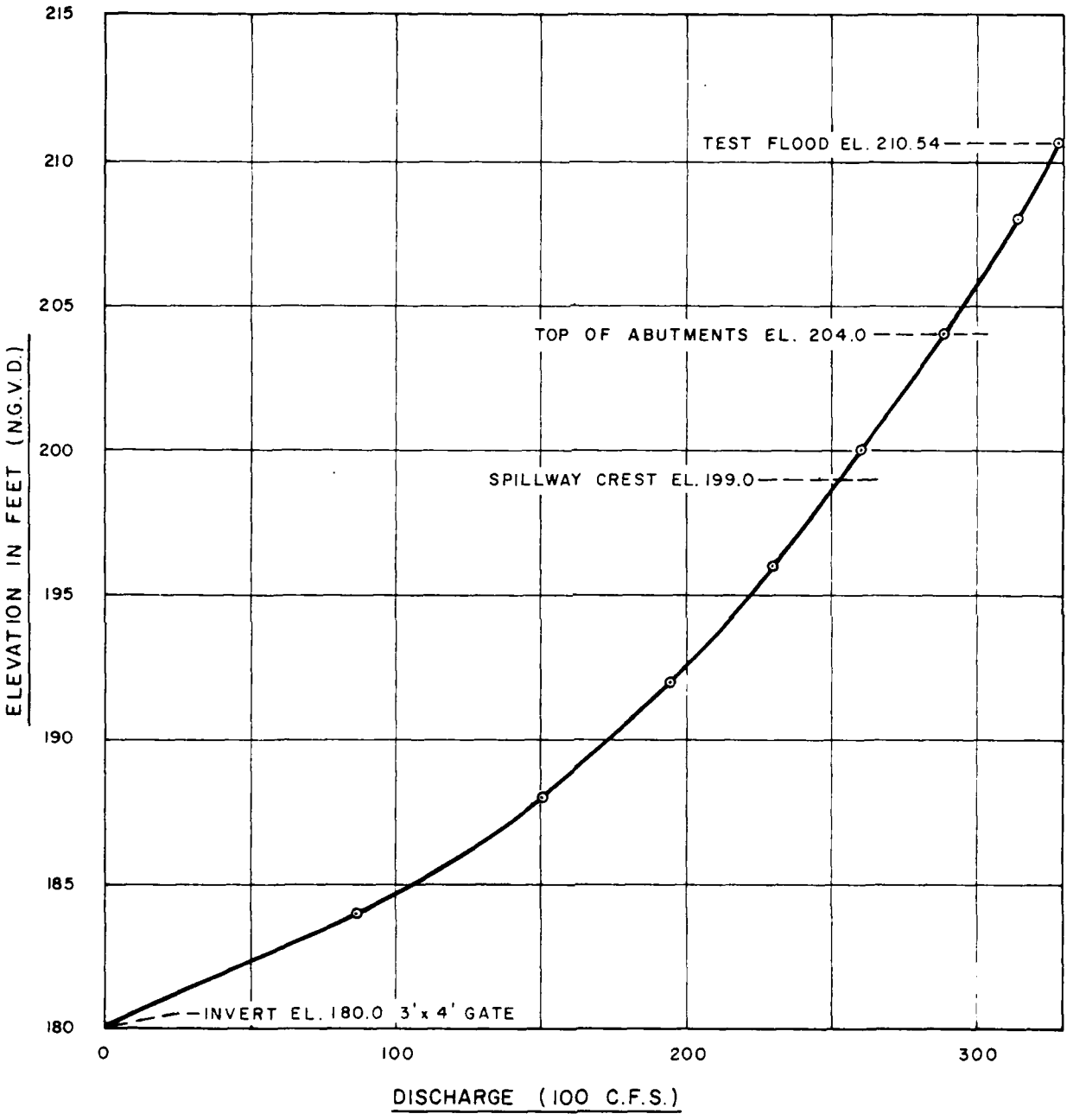
% of "test flood" overflow carried by spillway without overtopping = 28.7 %

"test flood" outflow discharge portion which overflows over the dam = 12400

% of test flood which overflows over the dam = 71.3 %

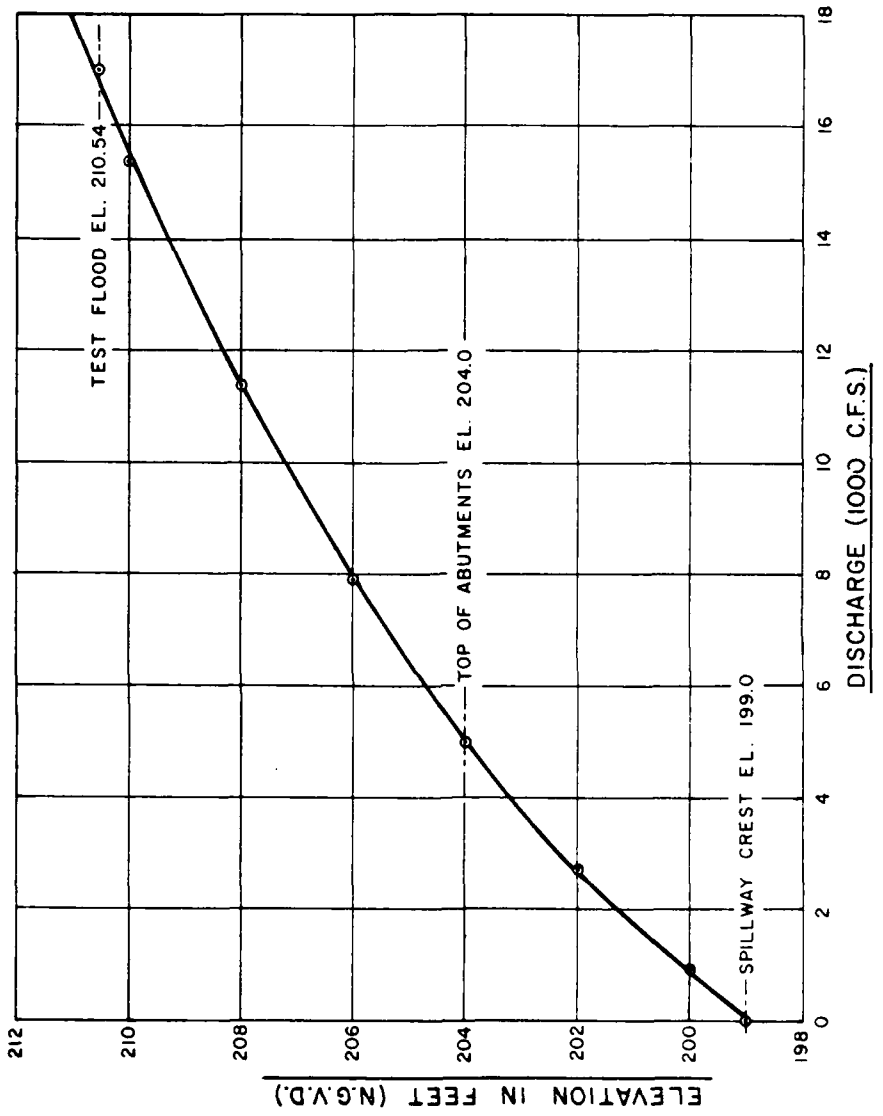
APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS



OUTLET RATING CURVE
FORESTDALE POND DAM

PLATE D-12



SPILLWAY RATING CURVE

FORESTDALE POND DAM

PLATE D-1

Forestdale Pond Dam

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

Effective Spillway width = 92.0 feet; Spillway crest elevation = 199.0 NGVD

Length of dam = Spillway width = 92.0 feet; Top of dam elevation = 204.0 NGVD

C = 3.70 for lower discharges and 4.13 for test flood

i) SPILLWAY RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Spillway Discharge (CFS)	Remarks
199.0	0	Spillway Crest Elevation
200.0	962	
202.0	2720	
204.0	4997	Top of Abutments
206.0	7920	
208.0	11384	
210.0	15380	
210.54	17000	Test Flood Elevation
NOTE: Spillway has three piers, 5.5 feet wide		

ii) OUTLET RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Discharge (CFS)	Remarks
180.0	0	Invert of Outlet
184.0	87	
188.0	150.5	
192.0	194.3	
196.0	230.0	
199.0	246.0	Spillway Crest Elevation
200.0	261.0	
204.0	288.0	Top of Abutments (Dam)
208.0	313.0	
210.54	328.0	Test Flood Elevation

Size of outlet = 3'W x 4'H; Area of outlet = 12.0 sq. ft.

Invert of outlet = 180.0; Center line of outlet = 182.0

DAM FAILURE ANALYSIS

STEP 5 -

Anticipated adopted minimum wave depth of flow = $d_{minimum}$
= $0.17y_o$ feet = 3.0 feet

$$(\frac{4}{9}\, y_o - d_{min.})\ (\frac{x}{x_{total}})^2 = 0.28\, y_o\ (\frac{x}{x_{total}})^2 \quad \text{where } x_{total} = 9250 \text{ ft.}$$

Distance from center line of dam = x	$(\frac{x}{x_{total}})^2$	Drop in depth	Water Surface Elevation as Unsteady Flow	Ground Elevation	Normal Depth	Adopted Water Surface Elevation
0	0	0	204.0 = Top of dam	--		204.0 = Top of dam
0	0	$\frac{5}{9}\, y_o$ = 10.0 ft.	199.0 = Spillway Crest Adopt 188.0	180.0	d_n	188.0 = just D/S of dam Adopt 195.0
10 + 00	0.01	0.05	187.95	180.0	15.0	195.0
20 + 00	0.05	0.25	184.75	177.0	15.0	192.0
30 + 00	0.10	0.50	181.50	174.0	15.0	189.0
40 + 00	0.19	1.00	178.00	171.0	15.0	186.0
50 + 00	0.29	1.50	174.50	168.0	14.0	182.0
60 + 00	0.42	2.10	172.90	165.0	14.0	179.0
70 + 00	0.57	2.85	168.15	162.0	14.0	176.0
80 + 00	0.75	3.75	163.25	159.0	14.0	173.0
90 + 00	0.95	4.75	159.25	156.0	12.0	168.0
92 + 50	1.0	5.00	155.00	152.0	12.0	164.0

Note: Adopted water surface elevation is higher of the two values:

a) Ground Elevation + $\frac{4}{9}\, y_o$ - drop in depth

OR b) Ground Elevation + d_n

Forestdale Pond Dam

DAM FAILURE ANALYSIS

NOTES:

1. $W_B \leq B$
2. Failure of dam is assumed to be instantaneous when pool reaches top of dam, and is a full depth - partial width rectangular shaped failure.

STF 1 - Dam Failure Discharge = Q_b

$$Q_b = \frac{8}{27} W_B \sqrt{g}\ y_o^{3/2} \left(\frac{B}{W_B}\right)^{0.25}* = 1.68\ B^{0.25}\ W_B^{0.75}\ y_o^{1.5}$$

$$= 9500 \text{ C.F.S.}$$

* Reference: Research note No. 5, "Guidelines for Calculating and Routing a Dam - Break Flood by the Hydrologic Engineering Center - C.O.E. - January, 1977.

Maximum Spillway Discharge = Q_S = 5000 C.F.S. (Entire length of dam is spillway)
(C = 3.7 B = 92.0 H = 6.0 ft.)

Gross length of spillway = 108.5 ft, ; Effective length = 92.0 ft.

STEP 2 - Wave Flow (Unsteady Flow) Characteristics

Depth of flow immediately downstream of Dam = $\frac{4}{9} y_o$ = 8.0 feet

Velocity of flow immediately downstream of Dam = $\frac{2}{3} \sqrt{gy_o}$

= 16.0 ft./sec.

STEP 3 - Adopted minimum possible depth of flow = 0.138 y_o = 2.5 ft.

Actual maximum possible velocity of flow = $2\sqrt{gy_o}$ =48.1 ft./sec.

Adopted theoretical maximum possible velocity = $\frac{2}{3}\ 2\sqrt{gy_o}$ = 32.1 ft./sec.

STEP 4 - Normal Flow (typical) Manning's Characteristics

Location of unwashable major obstruction Blackstone River

9250 = ft. D/S

S_o = 0.003 ; "n" = 0.07 ; Bed width of channel = b = varies

Total failure discharge = $Q = Q_b + Q_S$ = 9500 C.F.S.

Normal depth of flow for Q (9500 C.F.S.) = 15.0 feet = d_n

Normal depth of flow for Q (5000 C.F.S.) = 12.0 feet = d_n^1

Adopted maximum depth is larger of $\frac{4}{9} y_o$ or d_n = 15.0 feet

Adopted increase in depth due to failure of dam ($\frac{4}{9}y_o$ or d_n) - d_n^1 = 3.0 feet

Adopted maximum velocity of flow = $\frac{4}{3}\sqrt{gy_o}$ = 32.1 ft./sec.

Name of Dam: Forestdale Pond Dam

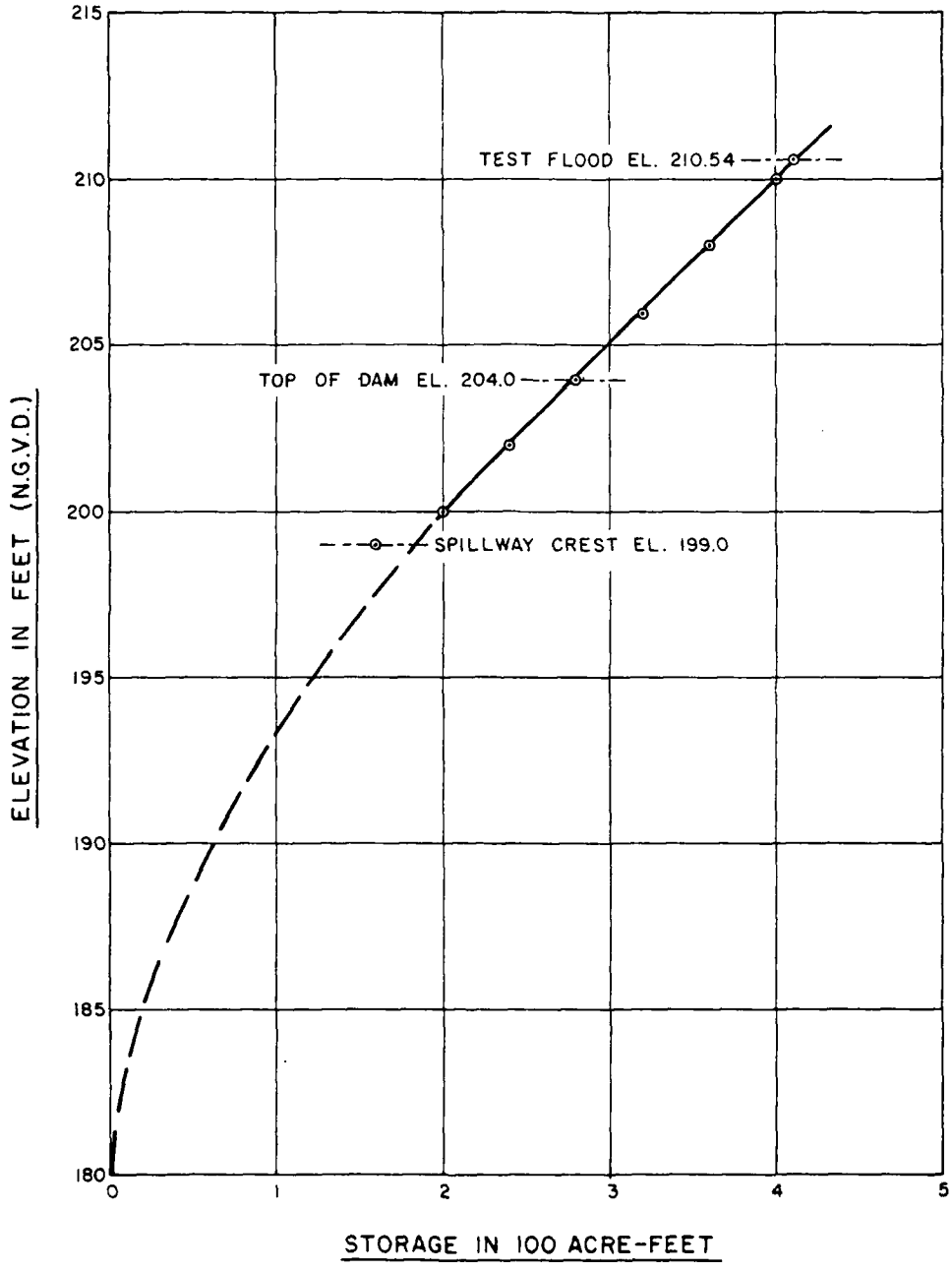
In addition to energy dissipation considerations, the volume of water which is available in the reservoir to sustain the flood wave must be considered. Important energy losses which occur as the flood wave moves downstream include friction, bend, obstruction, expansion and contraction losses, etc. The failure discharge and energy losses are also reduced by the failure hydrograph being modified by a decreasing peak due to available storages downstream. The analysis was based upon; i) undular wave rather than hydraulic bore; ii) impact of flood wave and the resulting energy loss were not considered; iii) the dam failure discharge of 9500 C.F.S. will merge with 5000 C.F.S. already flowing through the existing spillway, thus making a total outflow of 14,500 C.F.S. It is assumed that, prior to failure, the maximum spillway discharge has substantially filled the available storage areas downstream. Therefore, large storage areas are unavailable downstream and adjustment of outflow discharge is required. At a distance of 9250 feet downstream, the flow will merge with flows in the Blackstone River and convert its wave and kinetic energy back into pressure energy and steady and uniform flow.

NOTE:

1. Adopted water surface elevation is the higher of the two values:
   a) ground elevation + 4/9 y_o - drop in depth
   OR b) ground elevation + d_n
2. There are three depths for different characteristics of flow:
   a) Depth of flow immediately downstream of dam for unsteady flow conditions = 4/9 y_o
   b) Normal depth for $Q = Q_b + Q_s$ value of discharge = d_n = 15.0 feet
   c) Normal depth for $Q_s = d_n'$ = 12.0 feet
3. Maximum depth is greater of 4/9 y_o or d_n = 15.0 feet

   Maximum velocity of flow = $4/3\sqrt{gy_o}$ = 32.1 ft /sec.

   Increase in depth due to failure = (d_n or 4/9 y_o) - d_n' = 3.0 feet



STORAGE-ELEVATION CURVE

FORESTDALE POND DAM

PLATE D-6

"Rule of Thumb Guidance for Estimating Downstream Dam Failure Discharge"

BASIC DATA

Name of dam Forestdale Pond Dam Name of town North Smithfield

Drainage area = 91.2 sq. mi., Top of dam 204.0 NGVD

Spillway type = overflow; vertical fall Crest of spillway 199.0 NGVD

Surface area at crest elevation = 20 acres = 0.031 sq. mi.

Reservoir bottom near dam = 180.0 ft. NGVD

Assumed side slopes of embankments 2:1

Depth of reservoir at dam site 19.5 = y_o Failure height = 14.5 ft.

Mid-height elevation of dam = 189.0 NGVD

Length of dam at crest = 92 ft.

Length of dam at mid-height = 74 ft.

100% of dam length at mid-height = W_b = 74 ft.

Width of channel immediately downstream = B = 74.0 ft.; Shape of Breach = Rectangular

Elevation (NGVD)	Estimated Storage in AC-FT	
199.0	160	Spillway Crest Elevation
200.0	200	
202.0	240	
204.0	280	Abutment or Top of Dam Elevation
206.0	320	
208.0	360	
210.0	400	
210.54	411	Test Flood Elevation

Name of Dam: Forestdale Pond Dam

Estimating Effect of Surcharge Storage on "Test Flood"
[Routing of Flood Through Reservoir]

The routing of floods through the reservoir was carried out according to guidelines established by the Corps of Engineers in Phase-1 Dam Safety Investigations issued March, 1978.

Formulae used were the following for peak inflow = Q_{p1} in C.F.S.

Surcharge height to pass Q_{p1} in feet = $h_1 = \left[\frac{Q_{p1}}{CB}\right]^{2/3}$ ----------(1)

Surcharge storage in inches for surcharge height h_1 = $S_1 = \frac{S.A \times h_1 \times 12}{D.A}$ ---(2)
where S.A = surface area in square miles
where D.A = drainage area in square miles

$$Q_{p2} = Q_{p1}\left[1 - \frac{S_1}{\text{Total Effective Rainfall}}\right] \text{----------(3)}$$

First Approximation

Test flood inflow = _____ PMF = Q_{p1} = 17500 C.F.S.

h_1 = 13.80 feet

S_1 = 0.06 inches

Final Approximation

Test flood outflow = Q_{pfinal} = 17000 C.F.S.

h_{final} = 12.54 feet

S_{final} = 0.05 inches

In this final approximation, equations (1), (2) and (3) are satisfied by trial and error with total effective rainfall equal to 9.5 inches.

Estimating Maximum Probable Discharges - Inflow and Outflow Values Date of Inspection: November 6, 1979

Name of Dam Forestdale Pond Dam ; Location of Dam Branch River ; Town North Smithfield

Watershed Characterization Hilly terrain scattered with swamps, lakes, reservoirs; 10% of drainage area is swampy or occupied by storage reservoirs

Adopted "test" flood = Half PMF = 192 CSM = 17500 CFS; Re = Effective Rainfall = 9.5 inches

D.A. = Drainage Area (Gross) = 91.2 Square Miles; Basin Slope = 0.003 ft./ft hence; flat

S.A. = Surface Area of Reservoir = 0.031 Square Miles; Time of Concentration= more than 20 hours

Shape and Type of Spillway = overflow, vertical fall weir

B = Width of Spillway = Gross Length=108.5 ft, Effective " "=92.0ft. C = Coefficient of Discharge = (3.8 -Friction) = 3.70

Maximum Capacity of Spillway Without Overtopping = 5000 CFS = 29.4% of test flood outflow

Top of Dam Elevation = 204.0 ; Spillway Crest Elevation = 199.0

Overflow portion of Length of Dam = --- ; C = Coefficient of discharge for Dam = ---

Name of Dam	Test Flood Q_p CSM	Test Flood Q_p CFS	Inflow Characteristics h_0 in feet	Inflow Characteristics S_0 in in.	Outflow Characteristics First Approximation Q_{p1} CFS	h_1 in ft.	S_1 in in.	Outflow Characteristics Second Approximation S_2 in in.	h_2 in ft.	Q_{p2} CFS	Outflow Characteristics Third Approximation (Adopted) S_3 in in.	h_3 in ft.	Q_{p3} CFS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Forestdale Pond Dam	100 year =83.3	7600	7.91	0.035	-	-	-	-	-	-	0.03	7.64	7200
	½PMF =192	17500	13.80	0.06	-	-	-	-	-	-	0.05	12.54	17000

Q_p = Discharge; h= Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

A. Size Classification — Forestdale Pond Dam

Height of dam = 19.5 ft.; hence SMALL

Storage capacity at top of dam (elev. 204.0) = 280 AC-FT.; hence SMALL

Adopted size classification SMALL

B. Hazard Potential

The dam is classified as having a SIGNIFICANT hazard potential because its failure may result inloss of a few lives, damage to the Branch River gaging station, the North Smithfield trunk sanitary sewer main, Forestdale Bridge #445 (Route 146), Branch River Bridge #108 (Route 146A) and a utility crossing and mill building adjacent to the roadway. Water depths may range from 15 feet immediately downstream of the dam to 12 feet at the confluence of the Branch and Blackstone Rivers. Velocities of flow are estimated to be as high as 32 ft./sec. Debris from the river banks will be carried along, causing increased damage from impact and flooding.

C. Adopted Classifications

HAZARD	SIZE	TEST FLOOD RANGE
SIGNIFICANT	SMALL	100 year to Half PMF

Adopted Test Flood = Half PMF = 192 CSM

= 17500 CFS

D. Overtopping Potential

Drainage Area 91.2 = 91.2 sq. miles

Spillway crest elevation = 199.0 NGVD

Top of Dam Elevation = 204.0 NGVD

Maximum spillway discharge Capacity without overtopping dam = 5000 CFS

"test flood" inflow discharge = 17500 CFS

"test flood" outflow discharge = 17000 CFS

% of "test flood" overflow carried by spillway without overtopping = 29.4%

"test flood" outflow discharge portion which overflows over the dam = 12000 CFS

% of test flood which overflows over the dam = 70.6%

NAME OF DAM: FORESTDALE POND DAM

ESTIMATING EFFECT OF SURCHARGE STORAGE ON "TEST FLOOD"

A. This routing of floods through the reservoir was carried out according to the guidelines established by the Corps of Engineers in Phase 1 Inspection for Dam Safety Investigations issued in March, 1978.

B. Formulas used are as follows:

i. For no overtopping: $Q = C_1 B_1 h_1^{3/2}$
For overtopping: $Q = C_1 B_1 [h + F.B.]^{3/2} + C_2 B_2 h_2^{3/2}$
For open channel flow: N/A
For orifice flow: N/A

Where:
C_1 = coefficient of discharge for spillway; B = length of spillway
C_2 = coefficient of discharge for dam; B_2 = length of dam
h_1 = head over spillway crest in feet; h_2 = head over top of dam in feet
F.B. = Free Board - (distance from Top of Dam to Spillway Crest) in feet

ii. Surcharge storage in inches = $S = 12 (h_1 + h_2) \frac{S.A.}{D.A.} = 0.004 h$
where S.A. = surface area = N/A
D.A. = drainage area = N/A

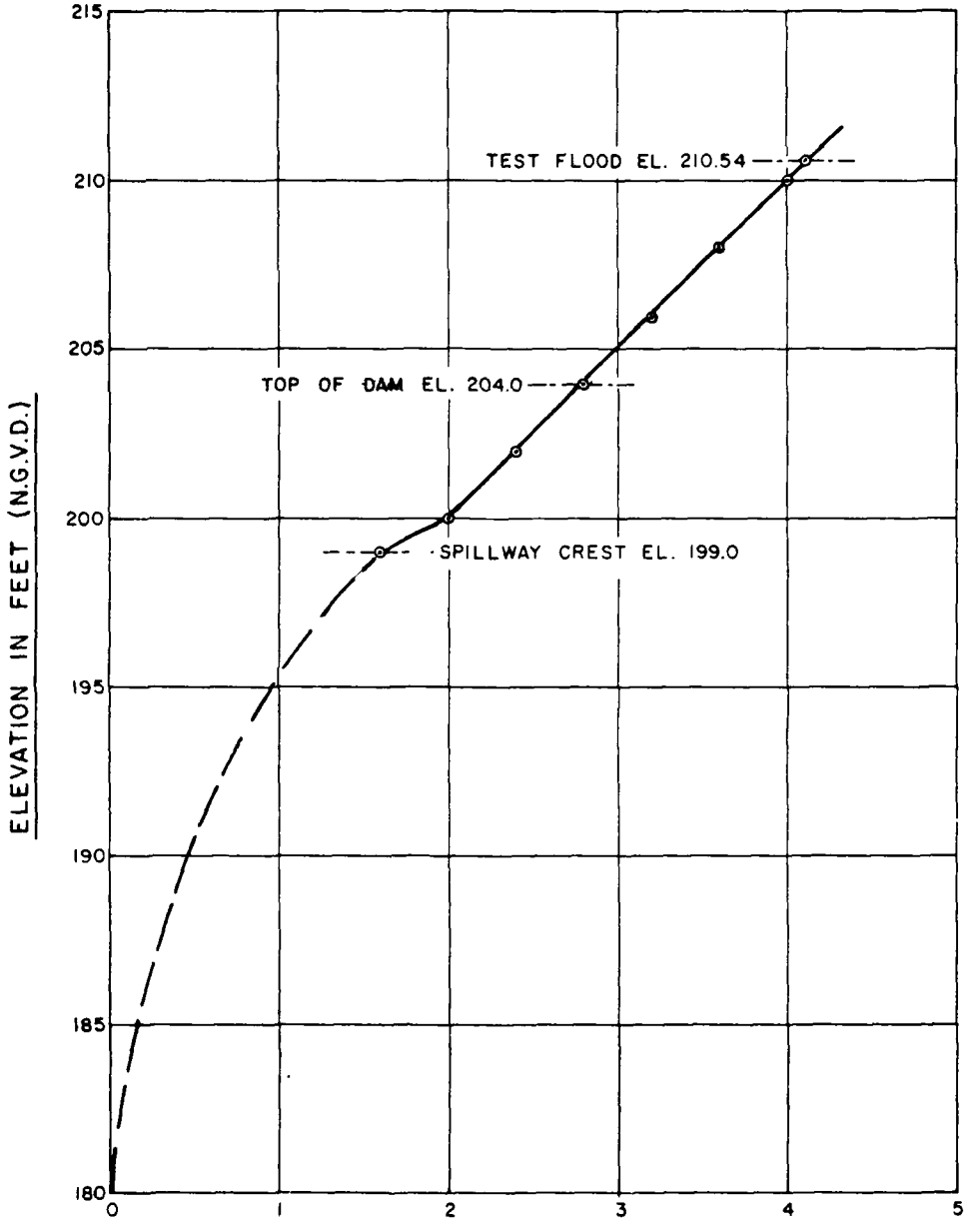
iii. $Q_{outflow} = Q_{inflow} (1 - \frac{S}{Re})$; where R_e = Effective Rainfall = 9.5"

iv. Length of dam = 16.5 ft. ; Top of Dam elev. = 204.0 ; c for dam = 3.80
Length of spillway = 92.0 ft. ; Spillway crest el. = 199.0 ; c for spillway = 4.13
(Entire length of dam is spillway)
$Q = 4.13 \times 92 (5 + h_2)^{1.5} + 4.13 \times 16.5 \times h_2^{1.5} = 5000$ C.F.S.
For h = Free Board = 5.0 feet : Q = 5000 C.F.S.
S = storage in inches = $12 h \frac{S.A.}{D.A.} = 0.04h$ where h is head over crest of spillway

v. $Q_{outflow} = Q_{inflow} (1 - \frac{S}{Re})$ when R_e = Effective Rainfall = 9.5"
Q_{inflow} = Test Flood = 17500 C.F.S.

Q in CFS	Elevation	Total Head over crest $h_1 + h_2 = h$	Storage in inches = S	Remarks
17455	205	6	0.024	
17441	207	8	0.032	
17424	209	10	0.040	
17411	211	12	0.048	
17395	213	14	0 056	
17382	215	16	0.064	
17400	210.6	11.6	0.047	

NOTE: Plot column ① and ② on Spillway Rating Curve
Intersection point will give Q, elevation and storage



STORAGE-ELEVATION CURVE

FORESTDALE POND DAM

PLATE D-6

i. DAM FAILURE ANALYSIS

A. Failure Analysis Discharge $= \frac{8}{27} W_B \sqrt{g}\, y_o^{1.5}$ C.F.S.

$= 1.68\, W_B\, y_o^{1.5}$

$= 9500$ C.F.S.

B. Maximum Spillway

Discharge with W.S.E.

At top of Dam @ 204.0 = 5000 C.F.S.

C. Total Dam Failure Discharge 9500 C.F.S.
[Entire length of dam is a spillway].

D. Reservoir - Storage Data:

Volume of storage at spillway crest =	160	AC-ft. @ Elev.	199.0
Surcharge storage at top of dam =	120	AC-ft. @ Elev.	204.0
Storage Total =	280	AC-ft. @ Elev.	204.0

E. Flood Discharge Channel

i. Maximum depth of flow just D/S of Dam = $\frac{4}{9} y_o$ = 8.0 feet

Notes:

1. Failure of dam is assumed to be instantaneous. When pool reaches top of dam, and is a full-depth partial width rectangular shape failure with a width of failure = W = 74 feet and depth of failure y_o = 14.5 feet.

2. Steady, uniform flow phenomenon is assumed for determination of failure profile and is based on Manning's formulae.

3. Failure profile for impacted area determination is determined at three typical cross sections in the downstream channel. Reduction in discharge due to available storage has been taken into account.

ii. Reach 1

Length = 5000 feet; Station 0 to Station 50+0; n = 0.05

Bed slope = $S_o \simeq S_f = 0.0025$; Bed width = b =

Bed width is scaled from U.S.G.S. map; scale 1" = 2,000 feet

As bed width is large and 1" = 2,000 feet and 10-foot contour interval scale maps are being used for various channel parameters, it is appropriate to assume that d = R = Hyd Radius = depth, hense Manning's formulae is transformed in this case with downstream channel parameters as adopted before.

$$Q = A \frac{1.49}{n} R^{2/3} \sqrt{S} = bd \frac{1.49}{n} d^{2/3} \sqrt{S}$$

b = 70' for depth 15.0'
b = 54" for depth 12.0'

$$Q = b \frac{1.49}{n} \sqrt{S}\, d^{5/3} = Kd^{5/3} = 104\, d^{5/3} \text{ for failure discharge}$$

$$= 80\, d^{5/3} \text{ for spillway discharge}$$

State Discharge Relationship for Reach 1

Depth = d in Feet	Stage of Elevation	Discharge in CFS = Q	Velocity in ft./sec.	Storage Volume in AC-ft. = V
0	174.0	0	0	0
2	176.0	250	2.31	12.40
4	178.0	800	3.70	24.80
6	180.0	1600	4.93	37.20
8	182.0	2550	5.90	49.60
10	184.0	3700	6.85	62.00
12	186.0	5000	7.71	78.40
14	188.0	7300	8.02	112.00
16	190.0	10550	9.42	129.00

F. Water surface profiles resulting from maximum spillway discharge and also from dam failure discharge are shown on Page D-98 for comparison purposes. This figure also shows the rise in water depth due to failure of dam.

Also, Discharge -- Depth and Storage-depth curves are shown on Page D9C for downstream channel.

Notes: 1. Storage volume in AC-ft = $\frac{\text{(Length of Reach) (Bed Width) (Depth)}}{43{,}560}$

2. Failure discharge being large will mostly be overbank flow on existing channel.

G. For Q_1 = 9500 CFS; depth = 15.0 ft. V_1 = 120 AC-ft.

Trial $Q_2 = Q_1 \left(1 - \frac{V_1}{\text{Storage}}\right) = 9500\left(1 - \frac{120}{120}\right)$ = 0 CFS

$\therefore V_2$ = 0 AC-ft.

Avg V = $\frac{V_1 + V_2}{2}$ = 60 AC-ft.

$\therefore Q_2 = Q_1 \left(1 - \frac{\text{V Avg.}}{\text{Storage}}\right)$ = 4795 CFS; y_2 = 11.60 ft.

Depth at center of flood as adopted = 15.0 ft.

H. Balance reservoir storage = 120 - 60 = 60.0 AC-ft.

Additional dam failure analysis beyond Reach 1 has not been undertaken because the depth of flow of 14.5 feet at the end of Reach 1, and this will not cause any hazardous conditions downstream. The failure discharge and depth will continually decrease beyond Reach 1. The impacted area due to the failure of the dam is shown on Plate D-1a.

SUMMARIZED AND ADOPTED VALUES

FOR

DAM FAILURE ANALYSIS

i. Name of Dam FORESTDALE POND DAM

ii. Dam Failure Discharge _____ = 9500 cfs.

iii. Maximum Spillway Discharge _____ = 5000 cfs.

iv. Total Dam Failure Discharge _____ = 9500 cfs.

v. Normal (Manning Depth) for 9500 = 15.0 feet

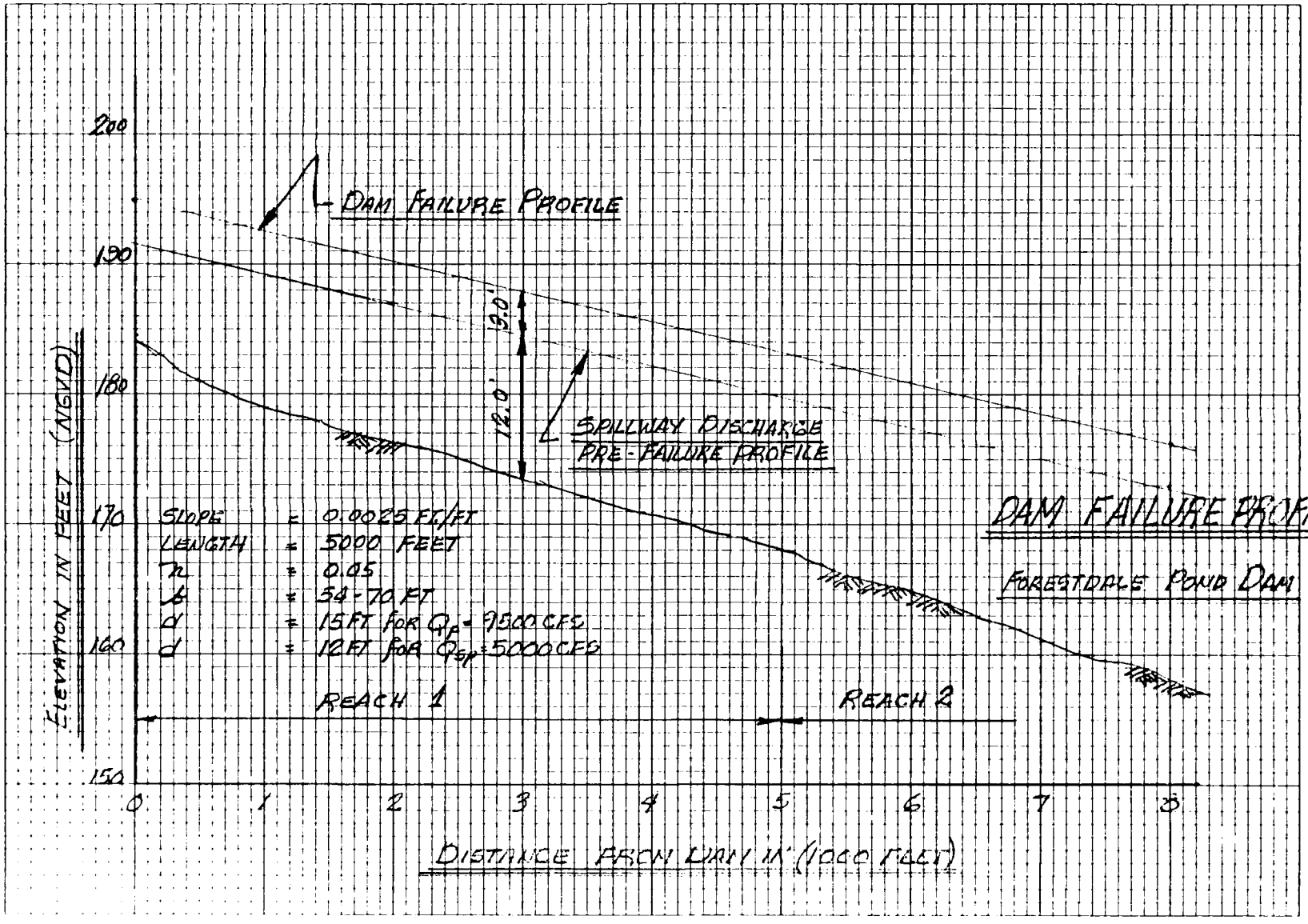
vi. Normal (Manning Depth) for 5000 = 12.0 feet

vii. Increase in depth due to failure of dam = 3.0 feet

viii. W.S.E. prior to failure = Ground Elevation + 12.0

ix. W.S.E. after failure = Ground Elevation + 15.0

Note: The adopted depth of flow values are assumed to be accurate representations of damages in the impacted areas. Professional judgement is used in these final adopted values.



DAM FAILURE PROFILE

FORESTDALE POND DAM

PLATE D-12

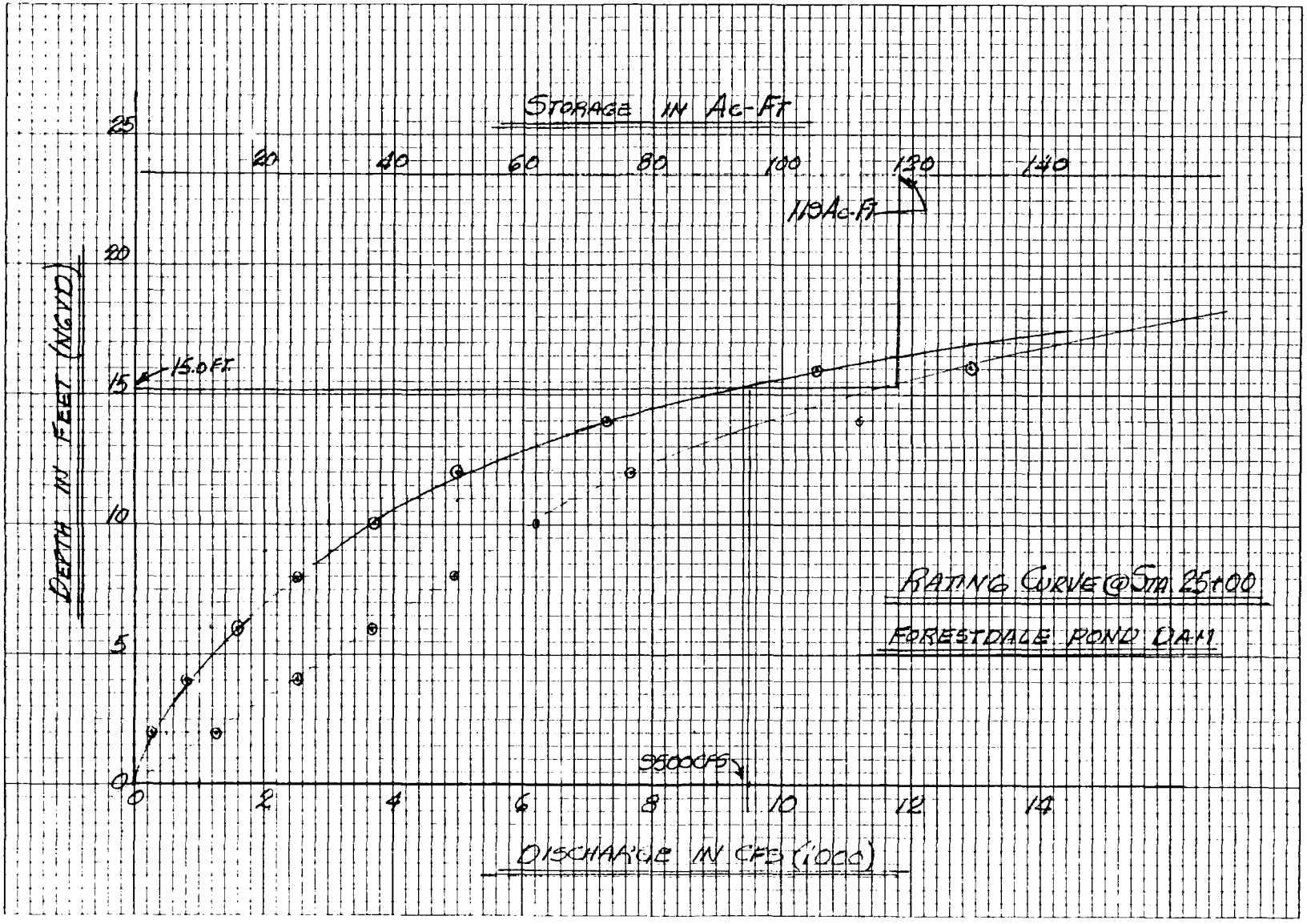

STORAGE IN Ac-Ft
0
20
40
60
80
100
120
140
119Ac-Ft
25
20
15
10
5
0
15.0 Ft
DEPTH IN FEET (NGVD)
RATING CURVE @ STA. 25+00
FORESTDALE POND DAM
9500 CFS
0
2
4
6
8
10
12
14
DISCHARGE IN CFS (1000)

PLATE D-12

Forestdale Pond Dam

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

Effective Spillway width = 92.0 feet; Spillway crest elevation = 199.0 NGVD

Length of dam = Spillway width = 92.0 feet; Top of dam elevation = 204.0 NGVD

C = 3.70 for lower discharges and 4.13 for test flood

i) SPILLWAY RATING CURVE COMPUTATIONS

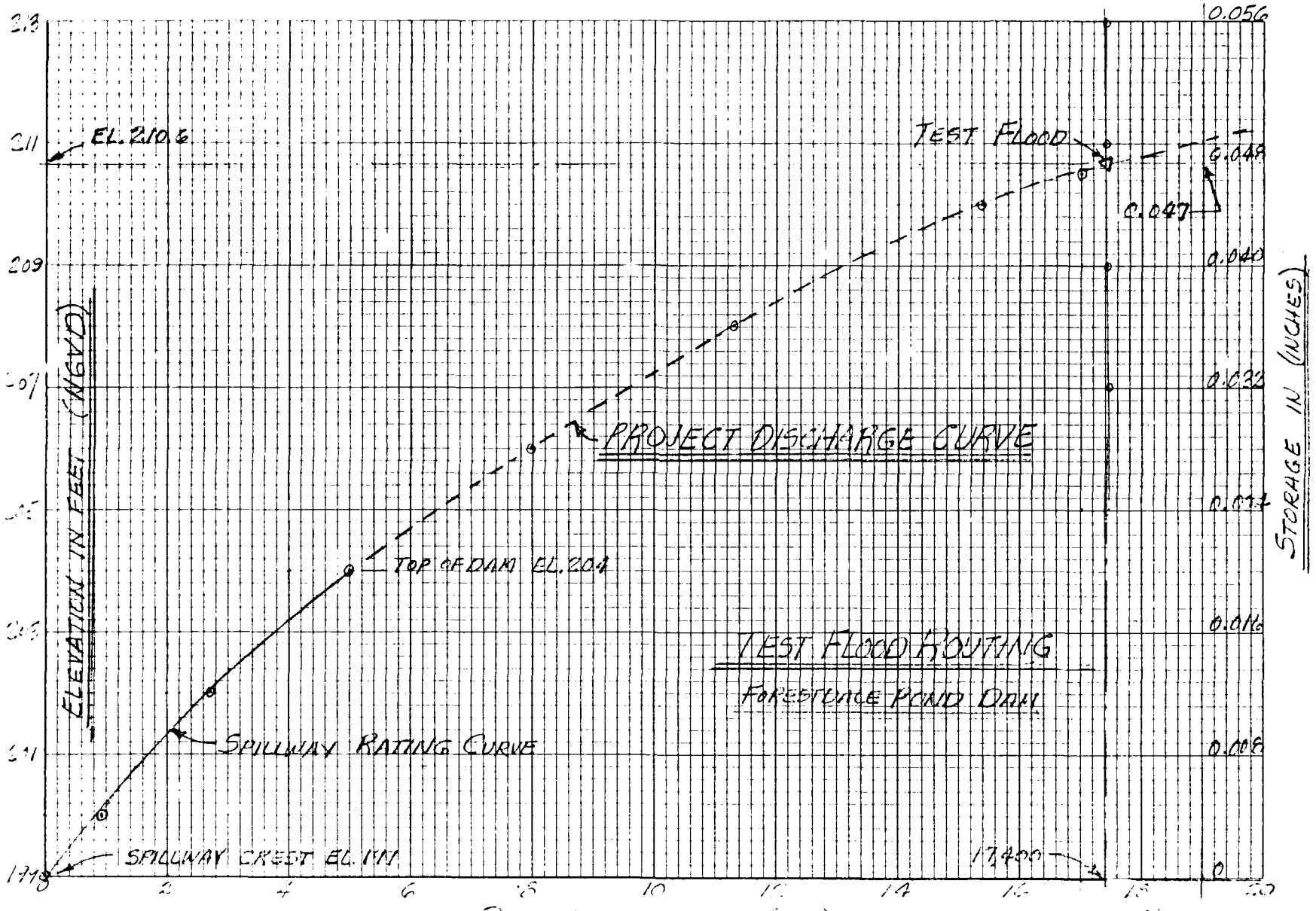
Elevation (ft.) NGVD	Spillway Discharge (CFS)	Remarks
199.0	0	Spillway Crest Elevation
200.0	962	
202.0	2720	
204.0	4997	Top of Abutments
206.0	7920	
208.0	11384	
210.0	15380	
210.6	17400	Test Flood Elevation
NOTE: Spillway	has three piers, 5.5 feet wide	

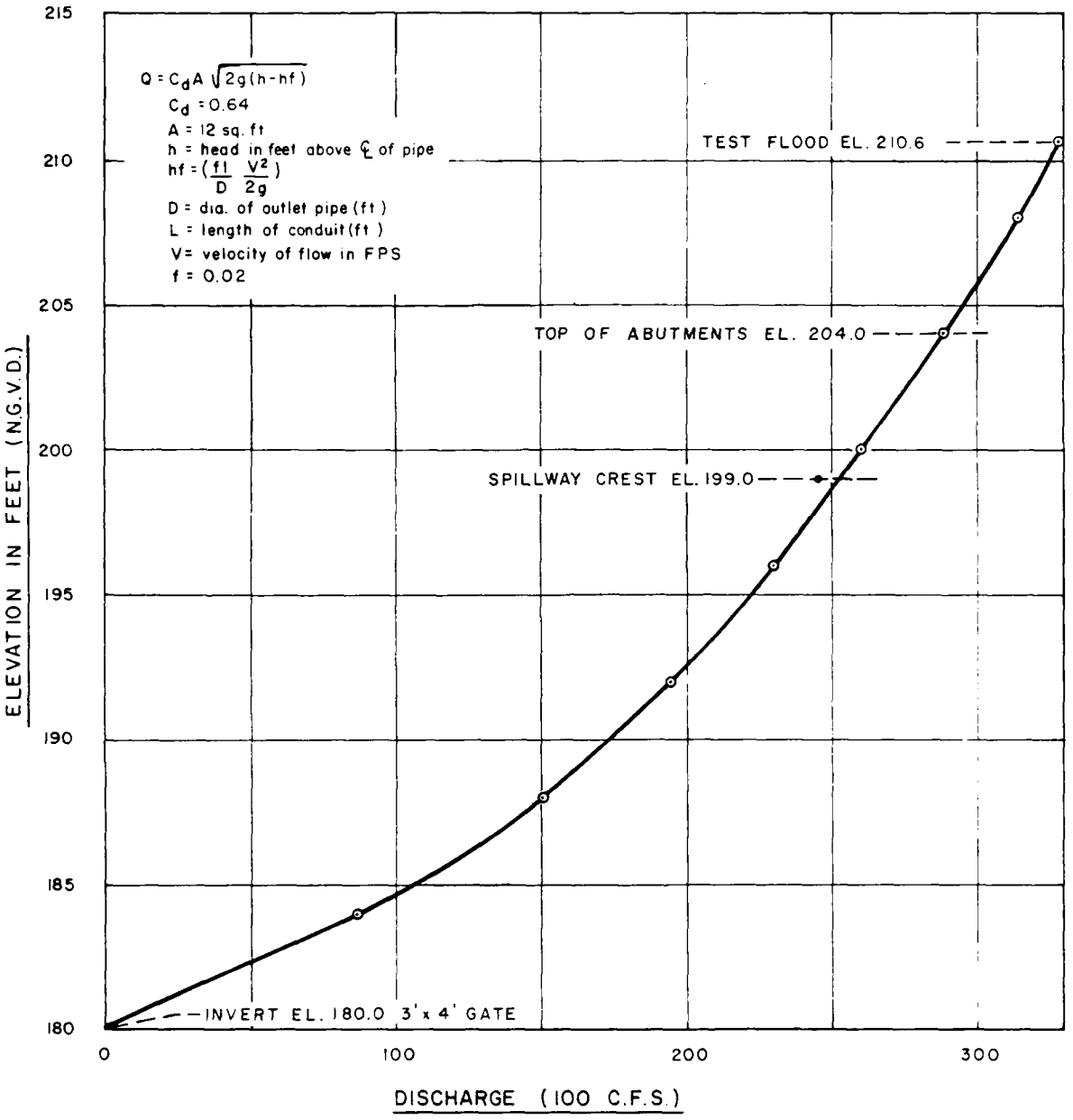
ii) OUTLET RATING CURVE COMPUTATIONS

Elevation (ft.) NGVD	Discharge (CFS)	Remarks
180.0	0	Invert of Outlet
184.0	87	
188.0	150.5	
192.0	194.3	
196.0	230.0	
199.0	246.0	Spillway Crest Elevation
200.0	261.0	
204.0	288.0	Top of Abutments (Dam)
208.0	313.0	
210.6	328.0	Test Flood Elevation

Size of outlet = 3'W x 4'H; Area of outlet = 12.0 sq. ft.

Invert of outlet = 180.0; Center line of outlet = 182.0


EL. 210.6
TEST FLOOD
PROJECT DISCHARGE CURVE
TOP OF DAM EL. 204
TEST FLOOD ROUTING
FOREBRUNCE POND ONLY
SPILLWAY RATING CURVE
SPILLWAY CREST EL. 194
17,400
0.047
ELEVATION IN FEET (NGVD)
STORAGE IN (INCHES)



OUTLET RATING CURVE

FORESTDALE POND DAM

PLATE D-12

END

DATE
FILMED

9-85

DTIC